U.S. DEPARTMENT OF COMMERCE
National Technical Information Service

PB-260 964

Air Pollution Abstracts Volume 5, Number 5, May 1974. 34896-35439

Environmental Protection Agency, Research Triangle Park, N C

May 74

TECHNICAL REPORT DATA
(Please read Instructions on the reverse before completing)

1. REPORT NO.
APABCA-5-5-1974

2.

3. RECIPIENT'S ACCESSION NO.

4. TITLE AND SUBTITLE
Air Pollution Abstracts Volume 5, No. 5

5. REPORT DATE
May 1974

6. PERFORMING ORGANIZATION CODE

7. AUTHOR(S)

8. PERFORMING ORGANIZATION REPORT NO.

9. PERFORMING ORGANIZATION NAME AND ADDRESS
Air Pollution Technical Information Center
Research Triangle Park, North Carolina 27711

10. PROGRAM ELEMENT NO.

11. CONTRACT/GRANT NO.

12. SPONSORING AGENCY NAME AND ADDRESS
Same

13. TYPE OF REPORT AND PERIOD COVERED

14. SPONSORING AGENCY CODE

15. SUPPLEMENTARY NOTES

16. ABSTRACT

This periodical is published to inform air pollution personnel of the Environmental Protection Agency (EPA), and others, of technical literature recently accessioned by the Air Pollution Technical Information Center (APTIC). For each accession, its Abstract Number, APTIC accession number, bibliographic citation, and abstract are given. Translations are cited with their sources whenever possible. The subject fields are as follow: Emission Sources; Control Methods; Measurement Methods; Air Quality Measurements; Atmospheric Interactions; Basic Science and Technology; Effects-Human Health; Effects-Plants and Livestock; Effects-Materials; Economic Aspects; Standards and Criteria; Legal and Administrative; Social Aspects; and General and Miscellaneous. All abstracts are listed under one of the above subject fields. A subject and author index are included. This issue contains abstracts 34896 - 35439.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Air pollution Abstracts Information retrieval		13B 5B

18. DISTRIBUTION STATEMENT
Unlimited

19. SECURITY CLASS *(This Report)*

20. SECURITY CLASS *(This page)*

21. NO. OF PAGES
122

22. PRICE
550

EPA Form 2220-1 (9-73)

PB 260 964

344046

Volume 5, No. 5
May 1974
APABCA-5(5)(1974)
US ISSN 0027 - 5956

AIR POLLUTION ABSTRACTS

34896-35439

MAY 1974

U.S. ENVIRONMENTAL PROTECTION AGENCY
Office of Air Quality Planning and Standards
Research Triangle Park, N. C. 27711

REPRODUCED BY
NATIONAL TECHNICAL
INFORMATION SERVICE
U. S. DEPARTMENT OF COMMERCE
SPRINGFIELD, VA. 22161

AIR POLLUTION ABSTRACTS

VOLUME 5, NO. 5 MAY 1974

Prepared by
Air Pollution Technical Information Center (APTIC)
Research Triangle Park, North Carolina 27711

Subscribers receiving 'Air Pollution Abstracts'
directly from the U. S. Government Printing Office
should address any inquiries regarding issues
subsequent to June 1972 to:

U. S. Government Printing Office, Washington, D. C. 20402

The Administrator of the Environmental Protection Agency has determined that the publication of this periodical is necessary in the transaction of public business required by law of this Agency. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through March 31, 1975.

CONTENTS

Introduction 3
APTIC Publications 5
Recent Contract Awards 6
Subject Fields and Scope Notes 8
Abstract Bulletin 11
Subject Index SI-1

The terms that most closely describe the information presented in the documents are arranged alphabetically.

Author Index AI-1

Personal authors are arranged alphabetically. The names are presented last name first. When the author is a primary author, an asterisk precedes the Abstract Number.

INTRODUCTION

This periodical is intended to inform personnel of the Environmental Protection Agency (EPA), and others who are also professionally interested in air pollution, of selected technical literature recently accessioned by the Air Pollution Technical Information Center (APTIC). For each accession, its Abstract Number, APTIC accession number, bibliographic citation, and abstract are given.

EPA's staff should direct requests for full text duplicates (if not locally available) to APTIC, using the order form provided. Translations of foreign language documents may be arranged for these personnel upon request. Commercially available translations may also be requested from APTIC.

For non-EPA readers, APTIC can provide copies of only those articles that have been written by EPA's air pollution personnel and have not been published in the open literature. Requests for all other articles should be directed to local libraries, publishers, or authors, with the following exception. Copies of EPA's numbered air pollution technical publications, as indicated in the citation, will be provided, while supplies permit, only to certain qualified requesters, e.g., its current contractors, grantees, and air pollution control agencies; a list of these publications is available. When requesting any publications from APTIC, please include the complete citation. Translations are cited with their sources whenever possible. If a translation proves to be unavailable from the source cited, or if a translation is cited without a source, it may be located through APTIC or through the National Translations Center,35 West 33rd Street, Chicago, Illinois 60616.

When NTIS or DDC or GPO appear at the end of the citation, they designate the sales outlet offering the document. NTIS refers to: National Technical Information Service, U. S. Department of Commerce, 5285 Port Royal Road, Springfield, Virginia 22151, Telephone (703) 321-8543. The designation NTIS is followed by their order number. NTIS sells paper copies at various prices and microfiche at $1.45. If payment does not accompany an order, NTIS will charge an additional $0.50 for each different title that is ordered in paper copy. DDC refers to: Defense Documentation Center, Cameron Station, Alexandria, Virginia 22314. Users registered at DDC may order such documents from them at the same prices as NTIS'. GPO refers to: Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402, Telephone (202) 541-3311. GPO sells paper copies at various prices; GPO does not sell microfiche. Payment must accompany all orders to GPO.

Semiannual cumulative indexes to both subject and author are also sent to all recipients of this monthly publication.

The serial publications (journals, periodicals, etc.) being scanned number approximately 7,000. A list of approximately 1,000 of the most productive publications with the address of each publisher is available upon request.

As another service, abstracts of all of the literature in APTIC (not just in a single issue of this periodical) on any subject related to air pollution will be provided free of charge upon request. APTIC can search information more recent than that in the current issue of this periodical because of the lapse of time entailed by editorial, make-up, and printing work.

More than 1400 subject index terms are available for such searching —more than those included in the subject index in each issue.

Acknowledgement is given to the Technical Publications Branch, Informational Services Division, Office of Administration, Research Triangle Park, N.C. for the make-up of the cover and for arrangement of printing and distribution.

Feedback from our users, including suggestions of articles, are always welcome.

APTIC Publications

Air Pollution Aspects of Emission Sources: Primary Lead Production - A Bibliography with Abstracts, June 1973, GPO No. EP 4.9:126, $0.65.

Air pollution Aspects of Emission Sources: Primary Copper Production - A Bibliography with Abstracts, June 1973 GPO No. EP 4.9:125, $0.70.

Air Pollution Aspects of Emission Sources: Pulp and Paper Industry - A Bibliography with Abstracts, March 1973, GPO No. EP 4.9:121, $2.35.

Air Pollution Aspects of Emission Sources: Primary Aluminum Production - A Bibliography with Abstracts, June 1973, GPO No. EP 4.9:119, $0.90.

Mercury and Air Pollution: A Bibliography with Abstracts, October 1972, GPO No. EP 4.9:114, $1.25.

Odors and Air Pollution: A Bibliography with Abstracts, October 1972, GPO No. EP 4.9:113, $3.00.

Air Pollution Aspects of Emission Sources: Petroleum Refineries - A Bibliography With Abstracts, July 1972, GPO No. EP 4.9:110, $1.25.

Air Pollution Aspects of Emission Sources: Iron and Steel Mills - A Bibliography With Abstracts, May 1972, GPO No. EP 4.9:107, $1.00.

Air Pollution Aspects of Emission Sources: Boilers - A Bibliography With Abstracts, May 1972, GPO No. EP 4.9:105, $2.00.

Hydrochloric Acid and Air Pollution: An Annotated Bibliography, July 1971, GPO No. EP 4.9:100, $0.55.

Chlorine and Air Pollution: An Annotated Bibliography, July 1971, GPO No. EP 4.9:99, $0.55.

Air Pollution Aspects of Emission Sources: Electric Power Production - A Bibliography With Abstracts, May 1971, GPO No. EP 4.9:96, $2.25.

Air Pollution Aspects of Emission Sources: Cement Manufacturing - A Bibliography With Abstracts, May 1971, GPO No. EP 4.9:95, $0.50.

Air Pollution Aspects of Emission Sources: Sulfuric Acid Manufacturing - A Bibliography With Abstracts, May 1971, GPO No. EP 4.9:94, $0.65.

Air Pollution Aspects of Emission Sources: Nitric Acid Manufacturing - A Bibliography With Abstracts, May 1971, GPO No. EP 4.9:93, $0.45.

Air Pollution Aspects of Emission Sources: Municipal Incineration - A Bibliography With Abstracts, May 1971, GPO No. EP 4.9:92, $1.00.

Photochemical Oxidants and Air Pollution: An Annotated Bibliography (2 Volumes), March 1971, GPO No. EP 4.9:88, $6.25.

Beryllium and Air Pollution: An Annotated Bibliography, February 1971, GPO No. EP 4.9:83, $0.40.

Asbestos and Air Pollution: An Annotated Bibliography, February 1971, GPO No. EP 4.9:82, $0.50.

Municipal Incineration: A Review of Literature, June 1971, GPO No. EP 4.9:79, $1.00.

Hydrocarbons and Air Pollution: An Annotated Bibliography (2 Volumes), October 1970, GPO No. HE 20.1309:75, $5.00.

The acronym GPO which appears in the above listing refers to: Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Orders should be directed to GPO only; payment must accompany all orders.

RECENT CONTRACT AWARDS

from the

Durham Contract Operations
Contracts Management Division, EPA

Contract No. 68-02-0758, RFP No. Du-74-440.. ***$261,159***

COMMUNITY HEALTH AIR MONITORING PROGRAM.

Rockwell International Corporation, Science Center, Post Office Box 1085, Thousand Oaks, California 91360

Contract No. 68-02-1388, Task Order No. 5 .... ***$56,250***

DEVELOPMENT OF AIR QUALITY MAINTENANCE PLANS IN THE ST. LOUIS STUDY AREA.

Alan M. Voorhees and Associates, Inc., Westgate Research Park, McLean, Virginia 22101

Contract No. 68-02-1385, Task Order No. 5 .... ***$56,250***

DEVELOPMENT OF AIR QUALITY MAINTENANCE PLANS IN THE SAN DIEGO STUDY AREA.

TRW, Inc., 7600 Colshire Drive, McLean, Virginia 22101

Contract No. 68-02-1380, Task Order No. 2 .... ***$56,250***

AIR QUALITY MAINTENANCE PLANS IN METROPOLITAN BALTIMORE STUDY AREA.

Engineering Science, Inc., 7903 Westpark Drive, McLean, Virginia 22101

Contract No. 68-02-1376, Task Order No. 8 .... ***$56,250***

DEVELOPMENT OF AIR QUALITY MAINTENANCE PLANS IN THE DENVER FRONT RANGE STUDY AREA.

GCA Technology Division, Burlington Road, Bedford, Massachusetts 01730.

Contract No. 68-02-1383, Task Order No. 3 .... ***$29,000***

EMISSION INVENTORY OF OUT-STATE MISSOURI.

Radian Corporation, 8500 Shoal Creek Boulevard, Austin, Texas 78766

Contract No. 68-02-1414, RFP No. Du-74-A115.. ***$74,627***

SYSTEMS EXPANSION AND NEW CAPABILITIES DEVELOPMENT FOR COMPLIANCE DATA SYSTEM (CDS) AND HAZARDOUS AIR POLLUTANTS MANAGEMENT SYSTEM (HAPEMS).

The Research Corporation of New England, 125 Silas Deanne Highway, Wethersfield, Connecticut 06109

Contract No. 68-02-1410, RFP No. Du-74-A054.. ***$69,695***

METHODOLOGY DEVELOPMENT AND DATA COLLECTION TO UPGRADE NEDS AREA SOURCE DATA BANK.

Walden Research Division of Abcor, Inc., 359 Allston Street, Cambridge, Massachusetts 02139

Contract No. 68-02-0349, Modification No. 8.. *$64,768*
CHESS-CALIFORNIA, HEALTH DATA COLLECTION.
Copley International Corporation, 7817 Herschel Avenue, La Jolla, California 92037

Contract No. 68-02-0607, RFP No. Du-74-A610.. *$47,242*
CONTINUATION OF ENGINEERING STUDIES OF CONTROL OF AIR POLLUTION FROM STATIONARY SOURCES.
Research Triangle Institute, P. O. Box 12194, Research Triangle Park, North Carolina 27709 (NOTE: Contract contains options in the amount of $73,671)

Contract No. 68-02-1376, Task Order No. 7.. *$65,000*
DEVELOPMENT OF SUPPORTING DATA FOR INDIRECT SOURCE GUIDELINES DOCUMENT.
GCA Technology Division, Burlington Road, Bedford, Massachusetts 01730

Contract No. 68-02-1377, RFP No. Du-74-A217.. *$90,000*
MODELING OF SELECTED POWER PLANTS TO IMPLEMENT EPA POLICY REGARDING LOW SULFUR FUEL SHORTAGES AND FUEL SUBSTITUTIONS.
Walden Research Division of Abcor, Inc., 359 Allston Street, Cambridge, Massachusetts 02139

Contract No. 68-02-1343, Modification No. 2.. *$74,325*
FIELD MONITORING AND TECHNICAL SERVICES IN SUPPORT OF AIR POLLUTION ENFORCEMENT ACTIVITIES.
PEDCo-Environmental Specialists, Inc., Suite 8, Atkinson Square, Cincinnati, Ohio 45240

Contract No. 68-02-1353, Modification No. 2.. *$28,300*
EVALUATION OF FABRIC FILTER PERFORMANCE IN THE REMOVAL OF ASBESTOS DUST FIBERS.
IIT Research Institute, 10 West 35th Street, Chicago, Illinois 60616

Contract No. 68-02-0638, RFP No. Du-74-A026.. *$39,000*
REDIRECTION OF SCOPE OF WORK.
IBM Corporation, 18100 Frederick Pike, Gaithersburg, Maryland 20760

Contract No. 68-02-1005, Task Order No. 4.. *$103,825*
DEVELOPMENT OF METHODOLOGY FOR THE PROJECTION OF CRITERIA EMISSIONS TO THE YEAR 2000.
Booz-Allen Applied Research Division, 4733 Bethesda Avenue, Bethesda, Maryland 20014

Contract No. 68-02-1386, Modification No. 1.. *$54,851*
TASK ORDER TO PREPARE 10 YEAR AIR QUALITY MAINTENANCE PLAN GUIDELINE.
Research Triangle Institute, P. O. Box 12194, Research Triangle Park, North Carolina 27709

Contract No. 68-02-0756, RFP No. Du-74-C679.. *$165,819*
19,360 ADDITIONAL MAN-HOURS TO ACCOMPLISH OPERATIONS AND PREVENTATIVE MAINTENANCE SERVICE FOR REAL PROPERTY INSTALLED EQUIPMENT AND SHOP SERVICES FOR EPA FACILITIES IN NORTH CAROLINA.
Halifax Engineering, Inc., 5390 Cherokee Avenue, Alexandria, Virginia 22312 (NOTE: Contract has options in the amount of $343,776)

SUBJECT FIELDS AND SCOPE NOTES

1. EMISSION SOURCES

Information pertaining to an industry, process, or material associated with air pollution. Documents in this category are concerned primarily with characteristics of a specific class of emission sources including types, rates, industries; secondary coverage may include effects, control methods, etc.

2. CONTROL METHODS

Includes equipment and both specific source control and general abatement efforts. Included are documents describing the operating principles, design, operation, efficiency, etc., of equipment and methods of removing pollutants. The scope of the document can vary from a device for a specific source to an approach applicable to an entire industry--e.g., automobiles.

3. MEASUREMENT METHODS

Includes equipment as well as methods. Confined to development testing and evaluation of pollutant determination methods (sampling, analytical, monitoring) and equipment, as such. Data obtained by use of methods in specific applications are placed in the applicable subject categories.

4. AIR QUALITY MEASUREMENTS

Pollution measurements in the ambient air, generally related to specific geographical locations, such as area surveys. Also includes general reviews of area situations and emission source inventories.

5. ATMOSPHERIC INTERACTION

All chemical and physical phenomena occurring in the atmosphere Included is material on dispersion, air pollution forecasts, meteorological effects, topographical effects, photochemical reactions in the atmosphere, etc. Laboratory studies of photochemical reactions are assigned to Basic Science and Technology.

6. BASIC SCIENCE AND TECHNOLOGY

General discussions or data compilations for the basic physical and chemical properties of pollutants. Theoretical and laboratory studies on related chemical and biological reactions and mechanisms. Mass transfer and other basic knowledge related to process engineering applications in emission control or abatement. Excludes photochemical studies in the atmosphere and biochemical studies related to effects of air pollution.

7. EFFECTS--HUMAN HEALTH

Covers medical and epidemiological studies; biological effects other than those on plants and livestock produced by air pollutants; laboratory animal experiments.

8. EFFECTS--PLANTS AND LIVESTOCK

Effects on vegetation--crops, trees, other plants--and on livestock as distinguished from laboratory experimental animals.

9. EFFECTS--MATERIALS

Deterioration, corrosion, etc., of physical materials, buildings, and structures.

10. ECONOMIC ASPECTS

Economic implications of air pollution and its control, e.g., economic losses from pollution damage, and costs of control programs or equipment in general.

11. STANDARDS AND CRITERIA

Recommended or adopted guides, criteria and standards for allowable emission limits or pollutant concentrations, air quality, equipment characteristics, and fuels.

12. LEGAL AND ADMINISTRATIVE

Legal aspects include legislation, ordinances, rules, litigation, hearings, decisions, etc. Administration covers administrative and miscellaneous information concerning control agencies and control and research programs. Typical topics are personnel, budgets, contractual activities and program descriptions.

13. SOCIAL ASPECTS

Sociological and psychological aspects such as social attitudes public opinion studies, public relations, and public information.

14. GENERAL AND MISCELLANEOUS

Reviews of general problems, trends and background. Documents not assignable to other categories.

ABSTRACT BULLETIN

EMISSION SOURCES

1974

34896 **APTIC NO. 58878**

Borg, Anders, Ante Teder, and Bjorn Warnqvist

INSIDE A KRAFT RECOVERY FURNACE-STUDIES ON THE ORIGINS OF SULFUR AND SODIUM EMISSION. *TAPPI, 57(1):126-129, Jan. 1974. 13 refs. (Presented at the Environmental Conference of the Technical Association of the Pulp and Paper Industry, San Francisco, Calif., May 14-16, 1973.)*

Field measurements and theoretical studies on the processes occurring inside a kraft recovery furnace under various operating conditions and their relation to sulfur and sodium emissions were performed. Temperatures, gas and bed compositions, and the flows of S and Na through the boiler were surveyed. Sulfur and Na emissions originated from the secondary air/liquor spray level as well as from the bed. Sulfur from the bed was mainly emitted from areas of low temperatures, and a considerable fraction of the total S emissions was found to originate from the liquor gun level. Primary Na emission was mainly from the liquor particles and bed areas of high temperatures. A non-homogeneous temperature distribution in the furnace combustion zone tended to increase S as well as Na emissions.

34897 **APTIC NO. 58134**

Carter, Roy V. and Benjamin Linsky

GASEOUS EMISSIONS FROM WHISKEY FERMENTATION UNITS. *Atmos. Environ., 8(1):57-62, Jan. 1974. 9 refs.*

Source testing for air pollutants was conducted on grain fermentation units in a whiskey distillery; odorants were adsorbed on activated carbon, and analyses were made by gas chromatography. Six compounds found in the predominately carbon dioxide gas stream were ethyl acetate, ethyl alcohol, n-propyl alcohol, isobutyl alcohol, isoamyl alcohol, and isoamyl acetate. Ethyl alcohol comprised more than 99% (by volume) of the organic concentration. The experimental data indicated that instantaneous organic contaminant concentrations were functions of time in the batch-type fermenting process. The results have been provided in tabular and graph form and may be used to estimate emissions from similar processes. The quantitative data as measured and presented are lower than what actually existed at the emission point by 0-30% due to possible incomplete desorption from the activated charcoal. (Author abstract modified)

1973

34898 **APTIC NO. 58899**

Cadle, R. D., A. F. Wartburg, W. H. Pollock, B. W. Gandrud, and J. P. Shedlovsky

TRACE CONSTITUENTS EMITTED TO THE ATMOSPHERE BY HAWAIIAN VOLCANOES. *Chemosphere, 2(6):231-234, 1973. 7 refs.*

The relative concentrations of a large number of elements occurring in the particulate portion of the fume from Kilauea Volcano in Hawaii were measured. Most of the particulate fume consisted of impure, dilute, droplets of sulfuric acid. Most of the sulfur in the fume consisted of sulfur dioxide, sulfuric acid, and various sulfates. The particles also contained ammonium ion, chloride, sodium, magnesium, mercury, calcium, silicon, and other elements. Particles from the fume from Halemaumau crater at two different times and from the fumes of the lava lake of Mauna Ulu had similar, but not identical compositions. Although many of the elements are toxic, they are in nontoxic concentrations.

34899 **APTIC NO. 57884**

Edwards, J. B.

THE CHEMISTRY OF SPARK-IGNITION ENGINE COMBUSTION AND EMISSION FORMATION. *In: Engine Emissions. Pollutant Formation and Measurement. George S. Springer and Donald J. Patterson (eds.), New York, Plenum Press 1973, Chapt. 2, p. 33-76. 66 refs.*

The chemical reaction occurring within spark ignition engines are discussed. Each process is examined singularly, and the engine is viewed as a complex system involving parallel and sequential processes as well as feedback paths. Particular attention is paid to those chemical processes which result in reactive hydrocarbons, oxygenated hydrocarbons, carbon derivatives, carbon monoxide, nitric oxide, and particulate matter. The design of the engine, the composition of the fuel injected, and the maintenance of the engine all may influence the chemical phenomena in the engine and ultimately the compounds exhausted in the atmosphere. Engine inputs and outputs are described, as well as the ultimate fate of engine emissions. Combustion chamber design and reactor conditions (pressure, temperature, and residence time) affect engine emissions. Low-temperature and high-temperature reactions in the reactor are discussed. Reactor conditions, thermal reactions, and catalytic reactions in the exhaust system are also discussed.

34900 **APTIC NO. 57945**

Feldman, P. L. and D. W. Coy

COMPARISON OF COMPUTED AND MEASURED OPACITIES: LIGNITE-FIRED BOILERS. *Preprint, Air Pollution Control Assoc., Pittsburgh, Pa., 32p., 1973. 2 refs. (Presented at the Air Pollution Control Association, Annual Meeting, 66th, Chicago, Ill., June 24-28, 1973, Paper 73-168.)*

The correlation between opacity and particle size and other factors in emission from lignite-fired boilers is discussed. Opacity depends on the particle mass concentration, size distribution, and physical properties such as density and refractive index. Plume width and wavelength of incident light are also important. A computer program was developed to predict opacity given the above parameters as input data. The predicted opacities were then compared with measured values. The program was general to allow for input of any distribution of particle size, so it was not necessary to approximate the distribution by a single low-normal distribution. Extinction efficiency factors were calculated from the Mie equation using a subroutine developed by IBM. Opacities were calculated from the Lambert-Beer law with extinction coefficients evaluated by numerical integration over the size distribution of particles. Opacities were measured in the boiler using an optical trans-

Preceding page blank

missometer. A cascade impactor was used to measure particle size. Opacities were then calculated and compared to measured values. The calculated values were generally lower than the measured values. Hoverer, there was reason to believe that the mass concentration were too low as measured. Suitable correction of this brought the calculated opacities into better agreement with the measured. The sensitivity of the dependence of calculated opacity on the various input parameters was explored. Curves were established defining the significance of size effects on opacity. (Author abstract modified)

34901 APTIC NO. 57928

Gadomski, R. R., A. V. Gimbrone, Mary P. David, and W. J. Green

EVALUATIONS OF EMISSIONS AND CONTROL TECHNOLOGIES IN THE GRAPHIC ARTS INDUSTRIES PHASE II: WEB OFFSET AND METAL DECORATING PROCESSES (FINAL REPORT). *Graphic Arts Technical Foundation, Pittsburgh, Pa., Environmental Protection Agency Contract 68-02- 0001, Rept. APTD-1463, 532p., May 1973. 179 refs.*

NTIS: PB 226552/AS

A simple, reliable apparatus and procedure for integrated grab sampling using gas chromatography, and flame ionization detector was developed. Hydrocarbons, carbon dioxide, carbon monoxide, and methane emissions from printing operations were measured. The testing effort was directed first to assessment of emissions from the web offset process and then to metal decorating. Uncontrolled as well as controlled sources were studied, with examples of both thermal and catalytic incineration represented. The organic conversion efficiency of incineration equipment was also determined and related to operational parameters. In web offset, the effect of press speed, ink coverage, method of drying and type of incineration equipment on the quantity of organics emitted were determined. The contributions of paper and dryer exhaust to the total organic content of the stream were considered. Press speed and ink coverage determine the quantity of organics emitted. An equation of this direct relationship was developed that can predict the quantity of emissions when all parameters are known. Both dryer systems (direct-flame hot air and high-velocity hot air) served to oxidize some of the solvent vapors, with the former more effective than the latter. For each control (incineration) unit evaluated, a temperature range was determined which produced an organic conversion efficiency of about 95%. The individual and net effects on organic emissions for various coatings, ink and oven combustion products were determined. The organic emissions from lithographic operations were insignificant when compared to emissions from the coating operations. The major variables in the metal decorating process directly affecting organic emissions--the solvent fraction in the coating, area of the sheet coated, weight of coating or film applied and coater speed--were correlated and expressed in an equation as for web offset. Thermal and catalytic combustion equipment installations studied were effective in reducing organics. To characterize the effectiveness of incineration equipment in both the web offset and metal decorating operations to the maximum degree possible, four additional sources, chosen as being the most recent control installations, were studied. Cost information on the control units is presented. (Author summary modified)

34902 APTIC NO. 58255

Gentel, James E., Otto J. Manary, and Joseph C. Valenta

CHARACTERIZATION OF PARTICULATES AND OTHER NON-REGULATED EMISSIONS FROM MOBILE SOURCES AND THE EFFECTS OF EXHAUST EMISSIONS CONTROL DEVICES ON THESE EMISSIONS. *Dow Chemical Co., Midland, Mich., Environmental Protection Agency Contract EHS-70-101, APTD-1567, 215p., March 1973.*

NTIS: PB 224243/AS

The effect of emission control devices on the particulate emissions of an automotive power plant was investigated. There were five tasks: characterization of a particulate trapping system; definition of a particulate baseline for a 1972 Pontiac 400 CID engine with no emissions controls and using nonleaded and low-lead fuel; evaluation of the particulate emissions from the Pontiac engine equipped with three different oxidation catalysts; testing automobiles equipped with control devices for particulate emissions; and definition of a preliminary collection system for diesel engine particulate sampling. In all tasks, particulate mass emission rates were measured, as well as particulate mass size distribution, carbon and hydrogen, trace metal, and benzo-alpha-pyrene content of the particulate. Ammonia and aldehydes were measured in the exhaust gas condensate, and gaseous emissions were determined as a routine check on engine operating conditions. (Author abstract modified)

34903 APTIC NO. 57880

Goldish, J., G. Margolis, J. Ehrenfeld, and R. Bernstein

SYSTEMS STUDY OF CONVENTIONAL COMBUSTION SOURCES IN THE PRIMARY ALUMINUM INDUSTRY (FINAL REPORT). *Walden Research Corp., Cambridge, Mass., Environmental Protection Agency Contract EHSD 71-21, Program Element No. 1A2014, EPA-R2-73-191, 49p., April 1973. 20 refs.*

NTIS: PB 226291/AS

A systems study of conventional combustion sources, emissions, and control strategies for the primary aluminum industry has been conducted. Comparison between boiler emissions and process emissions indicated that the former account for less than 2% of the process emissions in the industry. Boiler emissions such as sulfur dioxide, oxides of nitrogen, and particulates were found not significant enough to warrant sophisticated control strategies because of the small size of the boilers (16,600 pph average), because of the trend in switching to gas and distillate oil fuels, and because of the growing tendency of the industry to buy its power rather than generate it. The only strategy recommended was the banning of coal stokers by 1975 and a suggested fuel switching policy for boilers which were burning coal in 1970.

34904 APTIC NO. 57888

Henein, N. A.

DIESEL ENGINES COMBUSTION AND EMISSIONS. *In: Engine Emissions. Pollutant Formation and Measurement. George S. Springer and Donald J. Patterson (eds.), New York, Plenum Press, 1973, Chapt. 6, p. 211-266. 103 refs.*

Diesel combustion and emissions are analyzed with emphasis on high-speed transportation engines. Diesel engines emit carbon monoxide, gaseous hydrocarbons, nitrogen oxides, sulfur oxides, particulates, oxygenated hydrocarbons (aldehydes) odors, and visible smoke. The main findings of studies on droplet evaporation and combustion, on spray in a lumped form, and on combustion studied by engine photographs are used to develop some combustion and emission models in an actual engine. Diesel engines can be divided into two major groups according to the method of producing turbulence in the cylinder -- direct-injection or open-chamber engines and indirect-injection or divided-chamber engines. In the first, turbulence is generated prior to combustion (primary turbulence); in the latter, turbulence is combustion-generated (secondary turbulence). The combustion and emission characteristics of these engines are studied. Emphasis is placed on the qualitative analytical approach rather than on detailed mathematical formulation. Combustion and emission models are developed for some of the systems and used to discuss experimental results. A comparison between the emission characteristics of the different systems is included. Methods of emission control and areas for future research are described. Pre-ignition processes and chemical reactions are described. Fuel evaporation, fuel-air distribution in the spray, combustion and emission formation, heat release rates, and effects of design and operating variables on emissions (fuel-air ratio, engine cycles, injection timing, turbocharging, fuel, and swirl) are discussed for direct-injection engines. Effect of design and operating variables (load, speed, and fuel injection) in indirect-injection engines are also discussed. Nitric oxide emission control can be achieved by injection timing, water addition, or exhaust gas recirculation, or a combination of these methods.

34905 **APTIC NO. 58274**

Kennedy, L. A. and Carlo Scaccia

MODELING OF COMBUSTION CHAMBERS FOR PREDICTING POLLUTANT CONCENTRATIONS. *Preprint, American Society of Mechanical Engineers, New York, 10p., 1973. 19 refs. (Presented at the American Society of Mechanical Engineers-American Institute of Chemical Engineers, Heat Transfer Conference, Atlanta, Ga., Aug. 5-8, 1973, Paper 73-HT-22.)*

The combustion processes within a combustor were numerically modeled. The furnace model consisted of a rectangular chamber with rear and forward facing steps. The fuel and oxidizer were injected from two separate inlets. The swirl produced by the oxidizer inlet vanes in the actual physical situation were modeled. The governing elliptical equations were solved using a modified Gauss-Siedel procedure. Upwind differences were employed in the nonlinear convective terms to insure stability for all the Reynolds numbers considered. A parametric study showed the influence of the inlet conditions on the interior recirculation flow. Methane combustion was studied within the model combustor with particular attention focused on the formation of nitrogen oxides and carbon monoxide. Stream lines, temperature profiles, and concentration profiles were obtained. The effect of inlet conditions on centerline profiles are discussed. Reaction mechanisms and kinetics are described. (Author abstract modified)

34906 **APTIC NO. 57783**

Luebs, R. E., K. R. Davis, and A. E. Laag

ENRICHMENT OF THE ATMOSPHERE WITH NITROGEN COMPOUNDS VOLATILIZED FROM A LARGE DAIRY AREA. *J. Environ. Quality, 2(1):137-141, 1973. 18 refs.*

Examination of a dairy cow population of 143,000 in an area of 150 sq km revealed enrichment of the atmosphere with distillable nitrogen (mostly ammonia) over an area exceeding 560 sq km. Concentration of distillable N2 in the atmosphere for a 35 sq km area where cow population density was approximately 1600 cows/sq km proved to be 20-30 times greater than at a control site outside the dairy area. Highest concentration of N2 were associated with wet corral surfaces and favorable evaporative conditions. Approximately 20% of the total N2 absorbed by acid-surface traps in the dairy area was nondistillable N2, while filtered air samples contained 5% or less. Rainfall delivered 3 times as much N2 to the land surface within the dairy area. The findings indicated that volatilization of N2 compounds from animal wastes can be minimized and that the N2 content of manure can be conserved by preventing excessive wetting of the wastes. (Author abstract modified)

34907 **APTIC NO. 57885**

Matula, R. A

MECHANISM OF HYDROCARBON FORMATION IN COMBUSTION PROCESSES. *In: Engine Emissions. Pollutant Formation and Measurement. George S. Springer and Donald J. Patterson (eds.), New York, Plenum Press, 1973, Chapt. 3, p. 77-151. 127 refs.*

Unburned hydrocarbon emissions from transportation systems are presently and will remain significant fractions of the total contribution to these classes of pollutant emissions through 1990. Therefore, some of the important factors associated with the formation and emission of HC from transportation systems are discussed. Directly related phenomena such as photochemical reactivity of exhaust gases, odor, and potential health hazards associated with peroxyacetyl nitrate (PNA) are considered. Recent experimental and analytical results dealing with ignition delays in low molecular weight HC-oxidizer systems are reviewed. These include experiments with methane, ethane, propane, higher alkanes, acetylene and ethylene. The production and emission of unburned hydrocarbons from engines are discussed. Analytical techniques for prediction of induction times, calculated induction times for methane-oxygen mixtures, calculated induction times for other HC systems, and induction reaction mechanisms are discussed. The effects of wall quenching of the flame on the production of unburned hydrocarbons, the sources of unburned HC in spark ignition, compression ignition, automotive, and aircraft gas turbine engines, and the effects of engine variables on HC emissions from spark ignition engines are discussed in some detail. Some of the effects associated with HC emissions on man and the environment, including smog, odor, and polynuclear aromatics are discussed.

34908 **APTIC NO. 57925**

Mazaika, Paul K.

TRENDS OF ENERGY USE IN CALIFORNIA AND THE SOUTH COAST AIR BASIN. *California Inst. of Tech., Pasadena, Environmental Quality Lab., National Science Foundation Research Applied to National Needs Grant GI-29726, Rept. EQL 6, 54p., May 1973. 22 refs.*

Consumption of energy in California increased by an average of 4.2% annually from 1960 to 1970. The source of the increase was an average 2.4% increase in population coupled with an average 1.7% increase in per capita usage. Approximately 90% of the energy used each year is from four sources: natural gas; motor fuels, including gasoline and diesel oil; fuel oil; and electricity not produced by gas or oil. A growth history of these four sources of energy and an estimated annual total is provided which assumes those four provide 90% of the energy used. Natural gas is the source of almost half the energy used in the state. Motor fuels are the source of about 25% of the energy used. Although the amount of electricity generated by hydroelectric and nuclear power is relatively small, the total amount of energy used to produce electric energy is about 20% of the energy budget. This is because gas and oil powered steam-electric generation have efficiencies of 1/3. It is assumed here that hydroelectric and nuclear power than 100% energy conversion. California imports 70% of the natural gas it uses each year. The state now produces almost all the electricity it uses, but by 1980 it appears that 15% of the electricity used here will be generated out of the state. The South Coast is even less self-sufficient than the state--currently about 20% of the electricity used here is imported and this figure is projected to rise to 40% by 1980. The direct cost of energy to the consumer has decreased as a percent of average income from 10.7% in 1960 to 9.0% in 1970. The real cost of natural gas and gasoline declined in this period, while the real cost of electricity increased slightly. (Author summary)

34909 **APTIC NO. 57883**

Myers, P. S., O. A. Uyehara, and H. K. Newhall

ENGINE EXHAUST EMISSIONS. *In: Engine Emissions. Pollutant Formation and Measurement. George S. Spring and Donald J. Patterson (eds.), New York, Plenum Press, 1973, Chapt. 1, p. 1-31. 28 refs.*

The exhaust emissions from spark ignition and diesel engines are described, including unburned hydrocarbons, carbon monoxide, oxides of nitrogen (nitric oxide), lead compounds, odors, particulates, and sulfur oxides. Their toxic properties and formation are described. Carbureted spark ignition, port injection spark ignition, naturally aspirated diesel, turbocharged diesel, gas turbine, and external combustion engines are described. Control devices such as thermal reactors and catalytic mufflers, the effect of driving cycles on emissions, and control techniques such as careful combustion chamber design, varying fuel/air ratio, particulate traps, and catalytic reduction of NOx are mentioned.

34910 **APTIC NO. 57886**

Newhall, H. K.

THE KINETICS OF POLLUTANT FORMATION IN SPARK-IGNITION ENGINES. *In: Engine Emissions. Pollutant Formation and Measurement. George S. Springer and Donald J. Patterson (eds.), New York, Plenum Press, 1973, Chapt. 4, p. 153-181. 24 refs.*

A thermodynamic study of mechanisms and processes responsible for pollutant formation and/or destruction is given including detailed consideration of chemical reaction rate theory and chemical kinetics. Many simultaneous reaction steps occur and intermediate chemical species form in spark ignition engines before the formation of final products. The chemical reactions pertinent to the bulk combustion gases are discussed with particular emphasis on the formation and destruction of nitric oxides and carbon monoxide. Reaction mechanisms and reaction rates are described.

34911 **APTIC NO. 57934**

Richardson, R. W.

AUTOMOTIVE ENGINES FOR THE 1980 S- EATON S WORLDWIDE ANALYSIS OF FUTURE AUTOMOTIVE POWER PLANTS. *Eaton Corp., Cleveland, Ohio, 17p., 1973 (?).*

Reciprocating piston engines will remian dominant well into the 1980s. The Wankel engine will receive increased use in passenger cars, possibly appraoching a 25% penetration by the mid 1980s, but probably much less. Wankels will be more significant for small engines, especially compared with multicylinder engines for recreational vehicles, perhaps reaching 50% of this market segment, but they will not significantly penetrate the small single-cylinder engine market. Wankels will not be significant in heavy-duty engine applications. Turbine engines have greater long-range potential in both cars and heavy duty applications and the Stirling engine probably even greater potential. In the rear future, the stratified charge engine looks potentially very attractive, offering the required low emission performance without costly hang-on controls and representing relatively minor tooling changes. Vehicle and engine manufacturers continue to approach change with caution and will follow conservative introduction and commercialization strategies. Economics will continue to be the dominant influencing factor, but social requirements, especially fuel consumption, will become more significant in influencing change to different engines. The overall conclusion, therefore, is that there still is considerable uncertainty as to the choice and rate of commericalization of specific engines, but no revolutions are likely in the near future. (Author summary)

34912 **APTIC NO. 57920**

Scheiner, B. J., R. E. Lindstrom, and D. E. Shanks

RECOVERY OF MERCURY FROM CINNABAR ORES BY ELECTROOXIDATION. *Bureau of Mines, Reno, Nev., Reno Metallurgy Research Center, RI 7750, 14p., 1973. 14 refs.*

An electrolytic technique for oxidizing ore slurried with brine was investigated to determine its effectiveness in extracting mercury from ores. Optimization experiments conducted on 2.5 lbs of Hg/ton ore resulted in 95% Hg extraction with operating conditions of 30 C, a current density of 0.5 ampere/sq in., and a treatment time of 3.5 hr. Corresponding power consumption amounted to 38 kW/hr/ton of ore treated. Amenability experiments conducted on 62 different Hg ores resulted in 90-99% Hg dissolution from ores containing 0.6 to 20 lbs Hg/ton of ore. Treatment time ranged from 1 to 7 hr in 4-20% sodium chloride solutions, and power consumption was in the range of 10 to 50 kW-hr/ton of ore. Pilot mill experiments in a 100 to 200 lb/hr extraction plant have been in progress to quantify power and reagent requirements. These data will be reported in a subsequent publication. This process results, however, in substantial losses of vapors and particulates from the condensing system.

34913 **APTIC NO. 57887**

Springer, G. S.

PARTICULATE EMISSION FROM SPARK-IGNITION ENGINES. *In: Engine Emissions. Pollutant Formation and Measurement. George S. Springer and Donald J. Patterson (eds.), New York, Plenum Press, 1973, Chapt. 5, p. 183-210. 25 refs.*

The physical and chemical properties of particulates from spark ignition engines are described, with special attention to the total amount emitted, size distribution, shape, chemical composition of total particulate matter emitted, and chemical composition of different size particulates. The properties above depend on fuel composition, make of engine, engine wear and maintenance, oil, exhaust system geometry and design, exhaust system surface, pressure and temperature in exhaust system, and operating condition (air/fuel ratio, speed, load, and spark timing). Comparisons of existing data are made wherever expedient. Particulate sampling outside and from the exhaust system is described.

34914 **APTIC NO. 57930**

Zacharkiw, Peter B. and William H. Womer

POLLUTION IN THE GROUND SUPPORT ENVIRONMENT (FINAL REPORT). *Naval Air Engineering Center, Philadelphia, Pa., Ground Support Engineering Dept., Naval Air Systems Command Contract AT A3405344/ 200B/2F00554401, Work Unit 04, Rept. NAEC-GSED-69, 4ND-NAEC- 5215/4A (Rev. 3-70), 24p., July 1973. 9 refs.*

NTIS,DDC: AD 764854

In the past, ground support equipment (GSE) has been considered a negligible source of air pollution when compared to aircraft emissions. In a study of the St. Louis airport, GSE contributed as much as 30% of the total aircraft emissions. Environmental Protection Agency (EPA) air quality standards have been set for vehicles up to 6000 lbs gross vehicle weight. However, these standards do not apply for off-the-road vehicles such as GSE. The emission levels of various pieces of GSE were measured using an exhaust emission analyzer. Measurements were made for carbon monoxide and hydrocarbons. Recently, a catalytic converter PTX-6 purifier manufactured by Englehard Industries, was installed and evaluated on a TA-75 tow tractor. Emission levels were reduced to a point where they were almost negligible. In a study of the St. Louis airport, the annual emissions of GSE were predicted for the future both with and without controls. These controls would become mandatory if GSE was put into the mobile vehicle class of standards. At this time, no air quality standards are set for GSE, but regulations should be enacted to require GSE to comply with the EPA standards for mobile vehicles. This action is recommended to improve the working conditions and safeguard the environment for Navy personnel, to bring the peace-time Navy into alignment with the specific emissions regulations promulgated by the EPA, and to establish a compliance arrangement under which the applicability of future EPA regulations to GSE may continue to be monitored. Noise pollution from GSE, and its control, are also discussed.

34915 **APTIC NO. 57811**

Environmental Protection Agency, Washington, D. C.

AIRCRAFT EMISSIONS: IMPACT ON AIR QUALITY AND FEASIBILITY OF CONTROL. *105p., 1973 (?). 32 refs.*

GPO

The results of a study by the Environmental Protection Agency on aircraft emissions and their control indicate that such emissions are significant contributors to the regional burden of pollution in comparison to other sources and will have to be controlled to meet National Ambient Air Quality Standards. Airports, viewed as concentrated area sources of pollution under one, will remain intense area emitters of pollutants when the emission densities in the surrounding region have been greatly reduced unless aircraft emissions are reduced. Control techniques for effecting aircraft emissions reductions which appear both feasible and economically attractive during the next two decades include: modification of ground operational procedures, development and demonstration of new combustion technology for major reductions in emission from second-generation turbine and piston aircraft engines, and retrofit of turbine engine fleets with existing technology for near-term reduction of emissions. Comparisons of emission densities for airports versus urban areas and cost estimates for modification procedures are provided. (Author conclusions modified)

1972

34916 **APTIC NO. 58163**

Benvenuti, F., G. Devitofrancesco, and F. De Luca

ENVIRONMENTAL POLLUTION CAUSED BY LIFTING TRUCKS WITH INTERNAL COMBUSTION ENGINES. *(Inquinamento ambientale provocato dai carrelli elevatori con motore a combustione interna). Text in Italian. Securitas (Rome), 57(8-9):709-722, 1972. 10 refs.*

Air pollution resulting from the use of lifting trucks with internal combustion engines (gasoline or diesel) has been examined for closed working places under normal working conditions. The data collected by various analytical techniques indicated that some types of pollutants, especially particulates, reach high proportions. Contributions made by these trucks to environmental pollution should thus be taken into consideration.

34917 **APTIC NO. 57911**

Craxford, S. R., M. -L. P. M. Weatherly and B. D. Gooriah

NATIONAL SURVEY OF AIR POLLUTION 1961-1971, VOLUME 1. *Warren Spring Lab., Stevenage (England), Air Pollution Div., 195p., 1972. 11 refs.*

A report concerned with the present state of air pollution by smoke and sulfur dioxide in the urban areas of the United Kingdom and with changes that have taken place in recent years is presented. Emissions, both for the United Kingdom as a whole, and for the standard statistical regions, have been estimated from the data on fuel consumption. Concentrations of smoke and SO2 in the air near ground level, as given by the National Survey, have been averaged for the urban areas of the United Kingdom as a whole, and for those in each of the statistical regions, and are discussed in the light of the emission data. The report is an introduction to the series of detailed regional reports on the Survey in which the concentration data will be considered town by town, and site by site. These are presented here for the South East region (excluding London) and for the greater London area.

34918 **APTIC NO. 57832**

Dunn, Richard L.

THE BURNING ISSUE: PROS AND CONS OF ONSITE INCINERATION. *Plant Eng., 26(8):75-78, April 20, 1972. 1 ref.*

A look at the pros and cons of onsite incineration indicates that most general solid wastes can be controlled to acceptable levels, often at a cost competitive with other waste disposal methods. Most emissions from other types of wastes can be controlled, but special equipment which can be costly may be needed. The setting of an average per pound selling price appears impossible without using specific equipment as an example because of the various individual area air pollution code requirements and the variety of optional or auxiliary equipment available to prospects. Application of traditional air pollution control equipment, primarily scrubbers, has become common practice, and stepped-up research on improved incinerator design has led to more efficient and complete combustion. The advent of controlled air or the starved air incinerator has dramatically reduced pollution control costs; however, these units are generally more expensive than their excess air counterparts. Attempts to control emissions of halogen and sulfur compounds have generally been unsuccessful, and wastes containing large amounts of material which would generate these pollutants are not considered likely candidates for incineration.

34919 **APTIC NO. 57839**

Finneran, James A.

SNG–WHERE WILL IT COME FROM, AND HOW MUCH WILL IT COST? Oil Gas J., 70(29):83-88, July 17, 1972. (Presented at the Petroleum Electric Power Assoc., Annual Conference, 44th, Tulsa, Okla., June 12, 1972.)

The carbon yield, thermal yield, and thermal efficiency of the synthetic natural gas reactions partial-oxidation/methanation, hydrogenation, and steam reforming are considered; and various processes for coal and oil gasification are examined in terms of applicability and cost requirements. Thermal efficiency considerations indicate a clear preference for the steam-reforming process. The major item entering into the cost of manufacturing SNG by naphtha gasification is that of the naphtha feedstock which contributes about 85% of the cost of the gas. New technology will permit gasification of crude oil, and it seems unlikely that gasification of any other intermediate oil fractions will be undertaken on any substantial scale. The British Gas Council fluid-bed hydrogenation process appears the most advanced for gasification of whole crude. Coal-gasification processes such as the Bigas process, the carbon dioxide acceptor process, the Hygas process, the Synthane process, and the Molten-salt process are also being developed. Third generation processes such as the Kellogg's molten-salt gasification process are expected to be more economic than those currently in the pilot stage. An interesting concept for use of coal for power generation, using gasification, in which coal is gasified with steam and air, not oxygen, under pressure promises to reduce capital cost significantly. The product gas which is diluted with nitrogen can be cooled and desulfurized under 300 psi using known techniques for sulfur removal. The resulting sulfur-free, clean fuel gas, too low in heating value for use as pipeline gas, can be used for an industrial or utility boilers. This concept has been suggested as an alternative to stack-gas scrubbing for coal-fired boilers.

34920 **APTIC NO. 57866**

Fujii, Seiichi and Osamu Minamino

RESEARCH CONCERNING DUST GENERATION CAUSED BY VARIOUS MOVEMENTS INDOORS. *(Shitsunai ni okeru kakushu dosa ni yoru hatsujin ni kansuru kenkyu). Kuki seijo (Clean Air-J. Japan Air Cleaning Assoc., Tokyo), 10(4):60-74, Sept. 1972. Translated from Japanese, 40p.*

The main modes and contents of dust generated indoors under various conditions were studied in a series of experiments using an experimental clean room, with and without ventilation. The main modes and contents of generated dusts measured were: cigarette smoking; office work (compiling documents, turning pages); standing up and sitting down; and putting on, taking off, and brushing clothing. Dust measurements were made by the weight method and by a counting method in which the amounts of dust generated per particle diameter were measured as a method of indicating the amount of dust generated. The optical density method was also employed. The above methods utilized scattered light particle measurements and paper filter devices. The amount of dust generated by smoking was found to be directly proportional to the speed, and the value of dust generated per cigarette was computed at 0.45-0.55 O.D. cu m/cigarette. Dust particles with particle diameters of 0.3-0.5 and 0.5-1.0 micron were not found to be generated by sitting down on a sofa, while for particles of 1.0-5.0 micron the amount of particles per movement was 8.3 times 10 to the 6. Dusts generated by brushing clothing were found in all size categories except for 10 micron and over. Cigarette smoking was generally found to be the chief factor for indoor dust generation with small particle diameters; while for dust with large particle diameters, movements like sitting down on a sofa were judged to be the chief factors. Data are presented for changes in dust concentration with passage of time for each mode investigated.

34921 **APTIC NO. 57779**

Gary, Howard C. and Kenneth O. Nilsen

ECONOMIC FORECASTS AND TRANSPORTATION PLANNING. *Society of Automotive Engineers, New York, Environmental Protection Agency, Washington, D. C., and Dept. of Transportation, Washington, D. C., Intern. Conf. Transp. Environ., Washington, D. C., 1972, p. 1-2. (May 31-June 2, Paper 720601.)*

Various established theories of transportation economics are examined and challenged; and consideration is given to the pollution caused by mass tranportation, the inadequacy, and the inefficiency of these systems. Challenge is made to the beneficial impact of transportation, the selection of analysis periods of appropriate duration for purposes of project evaluation, and analysis of spillover effects which bring gains or losses to others than those whom the facility was intended to serve. The implications of transportation planning are viewed as drastic if mass production, economies of scale, highly mechanized agro-chemical operations, and other resource-using, pollution- creating, features of current life are to be reduced in scope.

34922 **APTIC NO. 58281**

Hasserodt, U.

CURRENT AND FUTURE ENVIRONMENTAL PROBLEMS ARISING FROM ENERGY CONVERSION. *In: Environmental Quality and Safety: Chemistry, Toxicology and Technology, Frederick Coulston and Friedhelm Korte (eds.), Vol. 1, New York, Academic Press, Inc., 1972, p. 28- 40. 16 refs.*

A general survey of the present state of developments in environmental problems arising from energy conversion is presented and a forecast is given up to 1980. Primary consideration is given to the situation in the Federal Republic of Germany and the discussion is restricted only to environmental protection problems connected with the generation of heat and electric power in stationary units. Data are presented on the trend of emission of sulfur dioxide by combustion of various types of fuel (and coal) in industrial and domestic use and possible technologies for further reduction of these emissions are discussed. Emissions in the form of dust from combusting fuels and pollutants resulting from incomplete combustion are not regarded as a significant problem since they can be eliminated by using available equipment and proper combustion conditions. Contrary to sulfur dioxide there is an upward trend of nitrogen oxides being emitted in Germany. Additional steps for reduction are to be taken, but further information on the behavior of nitrogen oxides in the atmosphere is necessary. Additional problems may arise from the gaseous radioactive waste products of nuclear power generation, and the waste heat, the latter due to higher individual capacity as compared to plants using fossil fuels. (Author summary)

34923 **APTIC NO. 57782**

Swensson, Leonard K. and Jack L. Peterson

PRITCHARD MIXED-REFRIGERANT PROCESS IS NEW. *Oil Gas J., 70(41):96-97, 100, Oct. 9, 1972. (Presented at LNG-III, Washington D. C., Sept. 24-28, 1972.)*

A new simple-loop mixed-refrigerant process developed by J. F. Pritchard and Co. has been found suitable for small peak-shaving applications as well as large base-load liquefied natural gas plants. The close single-loop process is simple, predictable in performance, easy to optimize, and has a high thermodynamic efficiency, a minimum of equipment and controls, and low capital cost. Recovery of heavy hydrocarbons from natural-gas feed steams is accomplished by partial condensation of the feed gas, separation of ethane, propane, butanes, and heavier components by fractionation, and return of the natural gas to the refrigerant heat exchanger for final condensation and subcooling the LNG. Nitrogen in the feed gas, up to about 8 mole%, may be removed by flashing subcooled LNG at one or more pressure levels to produce a fuel gas suitable for gas turbines or gas-fired boilers. The first LNG plant completion employing the Pritchard mixed refrigerant process will be a peak-shaving plant for the Chattanooga Gas Co. at Chattanooga, Tenn. This plant employs a centrifugal compressor driven by a gas turbine.

1971

34924 **APTIC NO. 55540**

Crandell, Willard A.

ELECTRIC POWER GENERATION: OPTIONS FOR ENVIRONMENTAL IMPROVEMENT. *In: Man s Impact on the Climate. William H. Matthews, William W. Kellogg, and G. D. Robinson (eds.), Cambridge, Mass., MIT Press, 1971, Chapt. 47, p. 557-563.*

A brief outline of the various options available to lessen environmental pollution from electric power generation is presented. These involve choices of fuel, electric station and equipment design, methods of operation, and other variables. The pollutants discussed include carbon dioxide, oxides of sulfur and nitrogen, particulate matter, waste heat, and radioactive wastes. The options available to the electric utility industry for environmental improvement are many, but they are often contradictory and their ramifications are interrelated and their implications often complex.

34925 **APTIC NO. 55550**

Kups, Stanislas

AIR POLLUTION. *(La pollution atmospherique). Text in French. Double Liaison, 18(194):525-528, Oct. 1971.*

Sources of air pollution, the chief air pollutants, and the effects of air pollutants on surfaces and paint coatings are reviewed. Waste gases from domestic and indutrial heating processes, vehicle exhaust emissions, particulate matter, gases from chemical processes, and malodorous emissions from various technological processes are among the basic air pollutants. Dusts are emitted mainly by cement works that also release carbon dioxide and sulfur dioxide. Open-hearth furnaces emit dusts containing silicon, lime, aluminum, and iron oxides. Arsenic-bearing dust is emitted by copper melting plants. Toxic fluorine compounds are released by operations such as aluminum, beryllium, magnesium, and superphosphate production, as well as by glass works. Combustion processes generate mainly sulfur dioxide, nitrogen oxides, and carbon monoxide. The chief pollutants generated by motor vehicles are CO, hydrocarbons, aromatic hydrocarbons including carcinogenic compounds, nitrogen oxides, and SO2. Carbon monoxide, forming relatively stable carboxyhemoglobin with hemoglobin, is lethal in a concentration of 1%, while at 60 ml/cu m concentration can cause serious troubles. Rarefaction of wildlife, and especially of bees, stone deterioration, aggravation of cardiovascular diseases, forest damage, and corrosion of metal and painted surfaces are among the basic effects of air pollution.

EMISSION SOURCES

34926 **APTIC NO. 58230**

Purdom, P. Walton

ENVIRONMENT AND HEALTH. *In: Environmental Health. P. Walton Purdom (ed.), New York, Academic Press, 1971, Chapt. 1, p. 1-25. 38 refs.*

The nature of man-environment relationships as they affect man s health is discussed. The status of man s health represents the result of complex interactions between his internal biological system and the total external environmental system. Residues and wastes can endanger man s life support systems. Many activities of man, driving an automobile, generating electric power, processing chemicals and petroleum, manufacturing of products, and disposal of wastes may result, if uncontrolled, in the discharge of solid particulate and gaseous pollutants in the atmosphere. Environmental hazards can be categorized as biological, chemical, physical, psychological, and sociological. Environmental hazards vary in their manifestation, but fundamental principles of environmental control include: isolation, substitution, shielding, treatment, and prevention.

34927 **APTIC NO. 58285**

Davis (W. E.) and Associates, Leawood, Kans.

NATIONAL INVENTORY OF SOURCES AND EMISSIONS: VANADIUM - 1968. *Office of Air Programs Contract CPA-70-128, APTD-1511, 62p., June 1971. 9 refs.*

NTIS: PB 221655

An emission inventory was prepared to determine thhe nature, magnitude, and extent of the emissions of vanadium in the United States for 1968. The production and use of V in the U. S. was traced and charted. The consumption was 5498 tons, exports 741 tons, and imports 654 tons. About 80% was used in the production of steel. Emissions to the atmosphere during the year totaled 19,231 tons. Emissions due to the combustion of fuel oil and coal were 17,000 tons and 1750 tons respectively. Emissions resulting from the production of ferrovanadium were 144 tons, and those from the production of steel were 236 tons. (Author abstract)

1970

34928 **APTIC NO. 58288**

Diffenderfer, James W.

LONG HAUL CONVEYANCES. *Air Pollution Control Assoc., Pittsburgh, Pa., Proc. Air Pollution Control Assoc., Mid-Atlantic States Sect., Semi-Annu. Tech. Conf. Transp. Impact Air Pollut., Harrisburg, Pa., 1970, p. 26-30, 83-90. (Oct. 8-9.)*

The general history and problems of air pollution are described. Intercity travel is one of the major causes of air pollution. While the Interstate Highway System has been developed, public mass transit has been depreciated. The extent of air pollution is inversely proportional to the relative efficiencies of various modes of transportation. Freight services, fuel consumption, and passenger service in densely developed areas are discussed.

34929 **APTIC NO. 57850**

Maizza, Vito

A CONTRIBUTION TO THERMAL AND DYNAMIC PROBLEMS ON THE STEAM ENGINE FOR AUTOTRACTION. *(Contributo ai problemi termici e dinamici del motore a vapore per autotrazione). Proc. Nat. Conf. A.T.I., 25th, Bari, Italy, 1970. p. 1-15. 13 refs. (Sept.) Translated from Italian, 37p.*

An analysis of the characteristics of the steam engine asseses its value and practical application to less air-polluting automobile transport. Parameters involving the thermodynamic cycle, size of boiler and condenser-radiator, and load variations are considered in relation to efficiencies attainable. Rapid vaporization is shown to be capable of resolving several important problems in the utilization of steam as an automotive power source, and a more rational use of working fluids is suggested, based upon the examination of several types. Several schemes are indicated for boilers responsive to the needs of such a device. Present weight limitations of the steam engine should be eventually overcome by the employment of space-age technology on an industrial scale. (Author abstract modified)

34930 **APTIC NO. 57937**

Nickell, L. G.

COMPARISONS OF BURNING VS. NON-BURNING OF CANE. I. FIELD. *In: 1970 Reports, Hawaiian Sugar Technologists. Hawaiian Sugar Planters Assoc., Experiment Station, p. 101-110, 1970.*

Plants can absorb ozone, sulfur dioxide, peroxyacetyl nitrate, carbon monoxide, ethylene, and other pollutants. When 1 acre of sugar cane is burned, 1.5 tons of CO2 are emitted and 1 ton of oxygen is consumed. This burning occurs only once every 24 mo. During the same 24-month period, the acre of cane removed 96 tons of CO2 from the atmosphere and gives off 60 tons of O2. Thus, sugar cane is the best type of green belt. Criticism of the cane industry and cane burning is based on misinformation, the use of erroneous or nonpertinent data, and poor understanding of photosynthesis. Tests were made of the amount of trash removed by burning irrigated cane fields. Information was also gathered on the cost of not burning cane by comparing unburned field blocks with burned ones. In Waialua, Grove Farm, and Mauna Kea plantations, burned crops produced 14.87, 7.3, and 11.27 tons of sugar/acre, while unburned fields produced only 11.34, 6.9, and 10.57 tons sugar/acre, respectively. Thus, nonburning of cane would give disastrous economic results.

34931 **APTIC NO. 57796**

Dept. of Trade and Industry (England), Programmes Analysis Unit

SECTION II: SOURCES OF AIR POLLUTION. *In: An Economic and Technical Appraisal of Air Pollution in the United Kingdom., Chilton, England, Her Majesty s Stationary Office, 1972, p.18-73. 18 refs.*

The sources of gaseous and particulate air pollution in the United Kingdom are summarized. Of the major pollutants emitted by all sources, domestic and industrial heating systems account for 86% of the smoke, 12% of the sulfur dioxide, and 30% of the carbon monoxide. Industrial plants and their pollutants include the chemical and allied industries which emit sulfur, nitrogen, and metal oxides, fluorides, and ammonium compounds; the metal industries which emit red brown iron oxide, grit, dust, SO2, and smoke; the fuel industries which have the same pollutants as the heating systems; and other industries where emissions are principally smoke, grit, and dust. In petrol engines the principal pollutants arising are CO produced by incomplete combustion of rich fuel/air mixtures; hydrocarbons produced by incomplete burning of part of the fuel/air mixture, caused principally by quenching of the burning at the cool cylinder walls, and by the use of rich fuel/air mixtures; oxides of nitrogen produced by the combination of atmospheric oxygen and nitrogen at the high temperature generated during fuel combustion; lead produced by the decomposition of organo-lead anti-knock compounds in the petrol and released in the exahust gases, and SO2 produced from the sulfur left in the fuel after the refining process. The emissions are not affected by engine design or mode of operation.

34932 **APTIC NO. 57875**

Dept. of Health, Education, and Welfare, National Air Pollution Control Administration

NATIONAL EMISSION STANDARDS STUDY REPORT, APPENDIX-VOLUME 2: APPENDIX F (PART 1). *270p., March 1970.*

Brief descriptions of some of the major industrial manufacturing processes which emit air pollutants during operation are presented including maps of plant distributions by State and detailed listings of plants, their capacities, and locations. The industrial sources discussed are carbon black, portland cement, coal cleaning plants, coke (by-product), cotton gins, ferroalloys, grain mills and grain handling, iron foundries, and nitric acid.

1969

34933 **APTIC NO. 57862**

Falls, O. B., Jr.

CHANGING PATTERNS IN ENERGY TRANSPORT. *Power Eng., 73(5):28-33, May 1969. 7 refs.*

New competitive forces have been unleached by developments in electrical transmission at 500 kv and above. Transmission line capabilities have grown greatly, and more and more large blocks of energy are moving into metropolitan areas electrically rather than by fuel transport. In addition, many remote hydroelectric developments are now feasible. Various sources of energy and means of energy transport are available including electrical transmission, direct-current transmission, fossil fuel usage, transport of coal, and oil and gas transmission. Many factors influence the choice between transmission of electric energy and transport of bulk fuel. Public outcry against air and water pollution will certainly place future plants, both fossil fuel and nuclear, in the remote areas, resulting in the need for long transmission lines. In the last decade, advances in technology have made high voltage transmission of electricity not only possible, but economically favorable.

34934 **APTIC NO. 57894**

Hartler, Nils, Kjell Andersson, and Jan G. T. Bergstrom

THE FORMATION OF MALODOROUS COMPOUNDS. *(Bildning av illaluktande amnen vid sulfatkok). Text in Swedish. Kem. Tidskr., 81(2):22-27, 1969. 9 refs.*

The formation of organic sulfur compounds was studied for some modified kraft cooking processes in order to reduce odor formation, which is directly proportional to the amount of charged sulfur in the liquor. Thus, cooking with a sulfur-free liquor during a delignification stage resulted in reduced production of malodorous sulfur compounds. However, the pulp yield and delignification rate were lowered. In order to increase the delignification rate during the second cooking stage using a sulfur-free liquor, ammonium hydrogen sulfide and sodium hydrogen sulfide of pH 10 were added to the cooking liquor in the first stage. The pulps obtained had higher carbohydrate yield and were more easily defibrated as compared to one stage kraft pulps. However, during these cooks, formation of odorous compounds increased.

34935 **APTIC NO. 57812**

Mick, Allan and Dean McCargar

AIR POLLUTION PROBLEMS IN PLYWOOD, PARTICLEBOARD, AND HARDBOARD MILLS IN THE MID-WILLAMETTE VALLEY. *Preprint, Mid-Willamette Valley Air Pollution Authority, Salem, Oreg., 26p., March 24, 1969. 15 refs.*

An emissions inventory of the plywood, particleboard, and hardboard industries in the Mid-Willamette Valley area of Salem, Oregon has resulted in three separate problem areas for enforcement action or continued study: wigwam waste burners, air transfer systems, and veneer dryers. Collectively, all sources were found to annually emit 10,680 tons of particulates, 18,690 tons of carbon monoxide, 11,040 tons of hydrocarbons, 427 tons of nitrogen oxides, and 52 tons of sulfur dioxide. Annually the mills generate 954,000 tons of waste of which 377,000 tons are sold, 296,000 tons are utilized in steam and power production, and 281,000 tons are incinerated. A reduction of the amount incinerated to around 100,000 tons or less is expected by 1972.

1967

34936 **APTIC NO. 58003**

Aberbach, R. J.

NINETEEN SIXTY-SEVEN ENERGY SYSTEMS DESIGN SURVEY. *Power, 111(10): 512-515, Oct. 1967.*

A survey of hydroelectric power plants across the United States reveals that while hydroelectric power generation is increasing, the percentage of total electric power supplied by hydroelectric plants is decreasing. Returns also indicate a trend toward larger installations with larger units and an increase in the number of remotely controlled stations and underground power houses. Tabulated data provide information about the number of units per plant, design measurements of turbines and generators, and equipment manufacturers.

34937 **APTIC NO. 58001**

Gerlach, J. K. and F. E. Pawlek

KINETICS OF CHLORINATION OF METAL SULFIDES. *Trans. AIME (Am. Inst. Mining Metallurgical and Petroleum Engr.), vol. 239: 1557-1564, Oct. 1967. 15 refs.*

The chloridizing roasting of ores is applied when metal sulfides and oxides are to be coverted into soluble or volatile compounds. The chlorine required is either obtained from the admixed chlorides of sodium or calcium or added in the gaseous state. In the first part of the investigations the reaction rate of the chlorides of sodium or calcium with gas mixtures of sulfur dioxide-oxygen or SO2-O2 sulfur trioxide was measured during roasting of pyrite. The rate for reactions with gas mixtures SO2-O2 is dependent on the composition of the gas phase. If more than 1% SO3 is added to the roasting gas, the reaction rate is determined only by the concentrations of the SO3. In the second part, the reactions between chlorine and metal sulfides are discussed. The rate of formation of gaseous chlorine is higher by one order of magnitude than is the reaction rate between zinc sulfide and chlorine. The reaction rate of nickel sulfide and lead sulfide is considerably below that of ZnS.

1966

34938 **APTIC NO. 57852**

Feuerstein, Donald L.

A STUDY OF MALODOROUS PRODUCTS FROM THERMAL DECOMPOSITION OF KRAFT BLACK LIQUOR. *Thesis (Ph.D), California Univ., Berkeley, Univ. Microfilms, Inc., 1966, 119p. 42 refs.*

The generation of malodorous gases in the kraft pulping process was studied. Pyrolysis of the black liquor in the recovery furnace and emission from the evaporator resulted in the greatest atmospheric loading of the six major sources traced. Laboratory-scale pyrolysis of the black liquor yielded malodorous gases consisting of hydrogen sulfide, methyl mercaptan, dimethyl sulfide, and dimethyl disulfide, in addition to 20 other sulfur containing compounds of much lower concentration. Hydrogen sulfide and methyl mercaptan represented about 80% of the total S in gaseous form at 900 C and were acidic in nature. Detectable nonsulfur-containing gases produced by pyrolysis of the black liquor were hydrogen, methane, ethane, acetylene, carbon dioxide, and carbon monoxide. Various analytical methods used are described.

1965

34939 **APTIC NO. 57584**

Graham, Richard H.

NUCLEAR FUEL-COST TRENDS UNDER PRIVATE OWNERSHIP. *Proc. Am. Power Conf., vol. 27:210-220, 1965. 6 refs.*

Reactors using enriched uranium and light water have emerged as the preferred energy source for nuclear power plants. The energy source is the U-235 isotope at concentrations slightly in excess of its normal occurrence. Currently, slightly enriched uranium is produced and sold by the United States Atomic Energy Commission. The Atomic Energy Act of 1954 made possible broad private industrial participation in this field. The principle effects of private ownership are: competition in uranium procurement; private financing of fuel inventories; and, a nuclear economy optimized to electrical power generation. Two factors controlling feed material cost are the price of the ore concentrate and the price to convert it to UF6. The cost of feed material is anticipated to decline slightly from current levels. A constant world-market U3O8 price of $4.50/lb is anticipated. The current conversion cost of $1.23/lb of uranium will fall to $1.00 in 1970 and 50 cents in 1975. Current price for enrichment is $30.00 per unit of separative work. This will decrease to $25.00 in 1975, and $20.00 in 1980. The conversion of UF6 to UO2, the best form for power production, costs between $2.00 and $3.00/lb of contained uranium. Cost improvements can be expected from design simplification and increased volume. The cost of recovery of spent fuel is based on conversion of uranyl nitrate to UF6 suitable for enrichment. Total cost, including shipping, is estimated at $41.50/kg of contained uranium, dropping to $36.40/kg in 1980.

1963

34940 **APTIC NO. 57853**

McKelvey, V. E., T. W. Hunter, H. J. Barton, J. E. Guidry, and D. C. Duncan

SUPPLIES, COSTS, AND USES OF THE FOSSIL FUELS. *Interior Dept., Energy Policy Staff, 71p., Feb. 1963.*

Fossil fuel resources, costs, and supplies are discussed. Expected reductions in cost of transporting fuel and energy by coal pipelines, railroads, and high-voltage transmission and mine head plants are reported. Anticipated interconnection patterns for large electric grids are described for high capacity thermal generating plants, peaking power, pumped storage, and peaking power from tidal sources. The use of large electric grids is expected to reduce prices. Coal, fuel oil, and natural gas consumption and future trends in the total consumption of energy and fuels are reported. Fossil fuel reserves constitute an adequate supply of energy for the next few decades. Improved technology will lower the cost of extracting and transporting fuel, and will improve the efficiency with which the fossil fuels are converted to power. These gains will make it possible to utilize larger potential resources that are too costly to mine now. Eventually, other sources of energy will be needed.

1959

34941 **APTIC NO. [illegible]**

McBean K. D.

ROASTING, SINTERING, CALCINING AND BRIQUETTING. *In: Zinc. The Science and Technology of the Metal, Its Alloys and Compounds. C. H. Mathewson (ed.), New York, Reinhold, 1959, p. 137-173. 43 refs.*

The processes of roasting, sintering, calcining, and briquetting of zinc concentrates are discussed. The main purpose of roasting zinc ores is to convert the zinc sulfide into zinc oxide and to expel the sulfur dioxide gas. Multiple-hearth furnaces can treat an unlimited variety of concentrates without elaborate feed preparation. The credits of the several types of fluidization roasters include the production of rich SO2 gases, no requirement for mechanical equipment operating under high temperatures and good control of the roasting conditions. The SO2 is usually recovered for use in a contact acid plant. With suspension roasters, rich SO2 gases are obtained, no auxiliary fuel is needed, and the steam recovery exceeds one ton/ton of concentrate roasted. In sintering zinc ores, methods of reducing the volumes of exhaust gases should by developed. This would result in smaller fans, flues, and dust-catching equipment and lower handling costs. Calcining is the process of applying heat to ores, without oxidation of the minerals, to expel the water of hydration, carbon dioxide and other gaseous dissociation products. Briquetting is a process for compressing fine materials into small blocks of sufficient strength to resist handling and weathering without deterioration. It consists of preparing the zinc-bearing materials, preparing the coal or coke, mixing and plasticizing, pressing the plastic mixture in a briquetting machine, and drying, screening, and storing the finished briquettes.

34942 **APTIC NO. 57977**

Roberts, Elliott J.

PRODUCING SULPHUR DIOXIDE GAS. *(Dorr-Oliver Inc. Stamford, Conn.) U. S. Pat. 2,867,506. 8p., Jan. 6, 1959. 3 refs. (Appl. July 18, 1956, 1 claim).*

A process is described for treating sulfur-containing ores, such as iron sulfide, to produce a gas with a higher sulfur dioxide content than is possible to obtain with air roasting. Finely divided sulfide ores are partially reacted with a multivalent solid oxygen carrier, such as iron oxide in an initial reaction zone where a large part of the sulfur in the ore is oxidized to pure SO2. The partially treated solids are transferred to a secondary reaction bed where their residual sulfur is reacted with air to produce dilute SO2. This gas is utilized to fluidize the initial reaction bed and to dilute the SO2 produced to a gas of desired SO2 content. The SO2 content of the gas discharged from the initial reaction zone is controlled by regulating the quantity of air supplied to the secondary reaction zone. In a regeneration zone the solids are treated to raise their oxidation state and a portion of these regenerated solids is sent to the initial zone for reaction. By employing this process, the SO2 concentration may be varied from dilute to 30 to 40%. The SO2 can be collected and used.

34943 **APTIC NO. 58084**

Stephens, E. R., P. L. Hanst, R. C. Doerr, and W. E. Scott

AUTO EXHAUST: COMPOSITION AND PHOTOLYSIS PRODUCTS. *J. Air Pollution Control Assoc., 8(4):333-335, Feb. 1959. 7 refs.*

Samples of exhaust fumes from a six-cylinder, standard transmission car were taken at four modes of engine operation: acceleration, deceleration, idle, and cruise. The exhaust gases were sampled directly; they were not dried or passed through absorbents. The samples were mixed with oxygen. Analyses of the exhaust samples were made using a long-path infrared absorption cell and infrared and photolysis experiments. Some of the samples were irradiated to simulate the effects of sunlight on exhaust fumes in the air. The products observed were quite similar to the products found when pure hydrocarbons were irradiated with nitrogen dioxide in oxygen. The nitrogen dioxide was most concentrated during acceleration, hydrocarbons and olefins were greatest during deceleration, and carbonyl compounds were rarely found in exhaust fumes. Carbon monoxide was lowest during cruising. Products formed by irradiation were ozone, peroxyacetyl nitrate, formic acid, alkyl nitrate, and aldehyde. Nitrogen dioxide and olefins were reduced by irradiation. Infrared spectra of exhaust gases and photolysis products are shown. The composition of auto exhaust in ppm is tabulated.

1956

34944 **APTIC NO. 58199**

Barnhart, D. H. and P. C. Williams

THE SINTERING TEST, AN INDEX TO ASH-FOULING TENDENCY. *ASME Trans. (Am. Soc. Mech. Engrs.), 78(8):1229-1236, Aug. 1956. 2 refs.*

A laboratory test for determining the tendency of ash to form hard, bonded deposits in the convection-tube banks of coal-fired boilers is described. The test has been applied to several phases of the over-all ash deposition including the evaluation of factors in boiler operation, the classification of coal according to its ash-fouling characteristics, and the selection and testing of additives for inhibiting or preventing ash fouling. Increased sintering time and temperature caused significant increase in the fly ash strength. Addition of dolomite to the flue gases in the boiler caused a proportionate increase in fly ash deposits. Results showed that ash fouling is due primarily to the characteristics of the coal burned; coals with an alkali content exceeding 0.5% result in an ash deposit in the boilers.

1948

34945 **APTIC NO. 57841**

Gilbert, Nathan and Farrington Daniels

FIXATION OF ATMOSPHERIC NITROGEN IN A GAS HEATED FURNACE. *Ind. Eng. Chem., 40(9):1719-1723, Sept. 1948. 9 refs.*

The chemical kinetics of the formation and decomposition of nitric oxide were studied in a pilot plant experiment involving the production of nitric oxide from air in a pair of simple pebble bed furnaces constructed of magnesia refractories and heated with gas. Temperatures of 2100 C were obtained by passing air through one preheated bed before it mixed with fuel gas; nitric oxide was cooled in the second bed to temperatures of thermal stability below 1500 C before appreciable dissociation took place. Due to the absence of simultaneous furnace measurements, data obtained cannot be used for quantitative calculations but is sufficient to indicate that nitric oxide is formed in considerable quantities. Such results show that conditions were adequate to give the air sufficient time at high temperatures to approach equilibrium and to provide sufficiently rapid cooling for nitric oxide recovery. The effectiveness of pebble-bed chilling was verified by introducing a water-cooled copper capillary tube into the combustion zone and withdrawing samples simultaneously with the withdrawal of exit gases from the second pebble bed. Analyses showed no difference in nitric oxide content. A frequency factor of 10,000,000/atm/sec and a bimolecular reaction activation energy of 70,000 cal/mole are not in accord with Jellinek s measurements in the 1800 to 2200 C range, and it is hypothesized that the reaction may not be bimolecular.

1928

34946 **APTIC NO. 58195**

Budnikoff, P. P. and E. Shilov

THE REDUCTION OF SODIUM SULPHATE TO SODIUM SULPHIDE, PARTICULARLY BY HYDROGEN AND CARBON MONOXIDE IN THE PRESENCE OF CATALYSTS. *J. Soc. Chem. Ind., vol. 47:111T-113T, April 20, 1928. 11 refs.*

The results of experiments on reducing sodium sulfate by means of carbon monoxide and hydrogen in the presence of nickel and its salts are presented. In most of the experiments, 0.5 g of calcined sodium sulfate was mixed with a definite amount of the catalyst, heated in an electric furnace, and cooled in a current of the reducing agent. When cool, the mass was dissolved in water, and the sodium sulfide in the solution was determined. Nickel and its salts catalytically accelerated the reaction between sodium sulfate and carbon monoxide or hydrogen, but not in a sufficient degree for industrial application. Pure CO and pure sugar carbon separately do not reduce pure sodium sulfate at temperatures below 850 deg. It was concluded that the reaction between sodium sulfate and CO was Na2SO4 + 4CO equals Na2S + 4CO2, and that carbon is a catalyst. Carbon can react with carbon monoxide giving the monoxide. However, the reduction of CO2 is a much slower process. Therefore the exit gases consist of nearly pure carbon dioxide, at least in the beginning of the process. Carbon monoxide only escapes when the reduction of sodium sulfate is complete. When hydrogen is used as the reducing agent, the reaction begins at a temperature somewhat above 700 deg. Hydrogen sulfide can appear in the exit gases or be decomposed into hydrogen and sulfur depending on the temperature. At temperatures of about 1000 deg or higher sulfur dioxide appears in the exit gases as a result of an indirect reaction between sodium sulfide and sulfate.

CONTROL METHODS

1974

34947 **APTIC NO. 58124**

Blayden, Lee C. and K. J. Brondyke

ALCOA 469 PROCESS. *J. Metals, 26(2):25-28, Feb. 1974. 1 ref.*

The Alcoa 469 process for aluminum alloys simultaneously reduces hydrogen, inclusions, and undesirable trace elements to very low levels without fume. The process eliminates need of prior furnace fluxing with chlorine or compounds containing chlorides. A nonreactive-reactive fluxing gas mixture is bubbled countercurrent to metal flow through two types of packed refractory bed filters. Normally, the nonreactive portion of the fluxing gas mixutre is controlled at 90-99% argon, and the balance of the mixture is Cl2. Portions are dependent on quality requirements of the aluminum alloys being treated. The Cl2 flow is carefully balanced to react with the undesirable trace elements in a nearly stoichiometric manner so the process is free of Cl2 or chloride fume. Typical purity of metal treated is 0.12 ml H2/100 g, 0.0001% sodium and an acceptable inclusion level. Metal flow rates in excess of 50,000 lbs/hr have been treated successfully in production. The process is capable of metal purification which meets all known government pollution standards without requiring fume handling equipment. Capital expenditures to install the process are much less than that needed to install Cl2 fluxing on a furnace and treat the fume generated. Plant tests indicate total treatment can be accomplished for 0.5 to 0.10 cents/lb.

34948 **APTIC NO. 58133**

Cox, Lionel A. and Alan E. Ranger

HIGH-YIELD HYDROGEN SULFIDE PRETREATMENT KRAFT PROCESS-A STATUS REPORT. *TAPPI, 57(1):102-105, Jan. 1974. 5 refs. (Presented at the Annual Meeting of the Technical Association of the Pulp and Paper Industry, Chicago, Ill., March 5-7, 1973.)*

Results of the development of a high-yield hydrogen sulfide pretreatment kraft pulping process and a new H2S recovery system are summarized. Approximately 550 tons of high-yield pulp (14% yield increase based on pulp) was produced in a 14 ton/day pilot plant; and the paper machine running characteristics with the H2S pretreatment kraft pulp (high in hemicellulose) were very similar to those with normally used kraft pulps. A new H2S recovery system was developed to eliminate the need for extensive H2S gas handling equipment. Black liquor sulfidity was unchanged, and the solids load to the recovery boiler was less for H2S pretreatment pulping than for conventional kraft pulping. Sulfur emissions from the recovery boiler were not increased. The H2S pretreatment process resulted in greater yield without increasing the normal pollution level of conventional kraft pulping. (Author abstract modified)

34949 APTIC NO. 58112

Jarzebski, Stefan and Mieczyslaw Chojnowski

INFLUENCE OF SHAPES OF CORONA ELECTRODES ON DENSITY OF EMISSION CURRENTS IN ELECTROSTATIC DUST COLLECTORS. *Atmos. Environ., 8(1):29-40, Jan. 1974. 7 refs.*

A study was performed on the influence of various shapes of corona electrodes, especially tape electrodes, on the density of emission currents in electrostatic dust collectors. General characteristics and advantages of tape electrodes were: to shift the current voltage characteristic in the direction of lower voltages; to achieve this effect by increasing the width of the electrode while maintaining the distance between collecting plates; to considerably increase the emission from the electrode by producing a knife shaped edge; to facilitate the determination of spacing between electrodes for a given dust resistivity; and to reduce the costs of production. Tape electrodes with knife-shaped edges gave better results than those with spiked edges when the width of the former was equal to the width of the latter, exclusive of the width of the spikes. Broad tape electrodes without sharp edges were marginally better than spiked electrodes, while narrow tape electrodes were lowest in merit.

34950 APTIC NO. 58101

Siegmund, C. W. and D. W. Turner

CONTROL OF NOX EMISSIONS FROM INDUSTRIAL BOILERS. *Bldg. Systems Design, 71(1):179-184, Dec./Jan. 1974. 17 refs. (Presented at the American Society of Mechanical Engineers, Industrial Power Conference, Louisville, Ky., May 14-20, 1973, Paper 73-IPWR-20.)*

An experimental program was carried out on a small oil-fired package boiler. The boiler was modified to permit operation with flue gas recirculation and two-stage combustion. The effects of fuel nitrogen content and excess air were studied. Nitrogen oxide emissions from liquid fuel combustion had two components. A fuel NOx component was equivalent to 40-50% conversion of fuel nitrogen to NOx for most fuel oils. A thermal NOx component came from fixation of N2 in the combustion air and depended on the design of the unit. Minimizing excess combustion air reduced NOx emissions by as much as 10-15% if the normal excess air level was relatively high (approximately 50%). Flue gas recycle was capable of reducing or eliminating the thermal NOx component with liquid fuel combustion, but did not affect the fuel NOx component. Two-stage combustion was capable of reducing both fuel NOx and thermal NOx from fuel oil combustion. With the present state of technology it would probably be difficult to apply flue gas recycle or two-stage combustion to most industrial boilers for NOx control. Both techniques have been used successfully on electric power generation boilers. (Author conclusions modified)

1973

34951 APTIC NO. 57950

Baldwin, J. M.

DETERMINATION OF MERCURY IN STACK GAS CAUSTIC SCRUB SOLUTIONS BY FLAMELESS ATOMIC ABSORPTION SPECTROPHOTOMETRY. *In: Analytical Methods Manual Part I. Methods Used by the Remote and Service Analysis Laboratory. Allied Chemical Corp., Idaho, Remote and Service Analysis Lab., Atomic Energy Commission Contract AT(10-1)-1375 S-73-1, p. 1-6, Oct. 1973. 3 refs.*

NTIS: ICP-1029, Chemistry TID-4500

Mercruy in stack gas caustic scrub solution can be determined by a modification of the Hatch and Ott method. The mercury (2+) and Hg2(2+) are reduced to Hg(0) by either a hydrazine hydrate or antimony(2+). Elemental mercury is purged from the solution by an air stream. Mercury is determined by passing the air through a 10 cm quartz window cell and measuring the absorbance at 253.7 nm in a flameless atomic absorption spectrophotometer. The apparatus, procedure, and calibration are discussed.

34952 APTIC NO. 58256

Bentley, David R. and Donald J. Schweibold

QUESTOR REVERTER EMISSION CONTROL SYSTEM: TOTAL VEHICLE CONCEPT. *Questor Corp., Toledo, Ohio, Questor Automotive Products Co. Rept. F and L-73-54, 33p., 1973. 11 refs. (Presented at the National Fuels and Lubricants Meeting, Houston, Tex., Sept. 13-15, 1973.)*

A vehicle emissions control system has been conceived and developed with the goal of reducing emissions to significantly less than the 1976 Federal standard of 0.41 g/mi hydrocarbon, 3.4 g/mi carbon monoxide, and 0.4 g/mi nitrogen oxides. This system utilizes known emission control methods in a unique sequence. The Reverter system utilized enriched carburetion and relies on three stages of operation: limited (or partial) oxidation of the exhaust gas without the aid of a catalyst, chemical reduction of nitric oxide aided by a catalyst in the presence of a CO rich atmosphere, and final and complete oxidation of the exhaust gas without the aid of a catalyst. The system was designed with special provisions for durability, high temperature controls, and catastrophic failure protection. It can operate on commercially available high or low-leaded fuels. Required operating parameters are described, such as air management and fuel requirements. Investigations of required system materials indicate the possibility of using both high temperature alloys and glass ceramics. Also described are subsystems which will control the operating temperatures under various engine load and speed conditions including catastrophic failure protection for the emission control system. Efforts are outlined to refine the total system further in terms of the development work necessary to lower system operating temperatures, thus reducing the associated fuel economy penalty and increasing the system s physical durability. (Author abstract)

34953 APTIC NO. 57955

Bienstock, D., P. D. Bergman, J. M. Henry, R. J. Demski, J. J. Demeter, and K. D. Plants

MAGNETOHYDRODYNAMICS--LOW AIR POLLUTION POWER GENERATION. *Preprint, American Society of Mechanical Engineers, New York, 12p., 1973. 20 refs. (Presented at the American Society of Mechanical Engineers, Winter Annual Meeting, Detroit, Mich., Nov. 11-15, 1973, Paper 73-WA/Ener-3.)*

Magnetohydrodynamics has very low air pollution potential. In pilot plant tests in which a 2.2 wt% sulfur coal was burned in a cyclone furnace at 200 lbs/hr and 4000 F at a seed concentration of 1 g mole potassium carbonate/kg coal, 99.8% removal of sulfur dioxide was obtained with only 5 ppm SO2 in the gaseous effluent. When the combustor was operated with 95% of stoichiometric oxygen and ambient air admitted at 2000 F, nitrogen dioxide emissions decreased to 150 ppm or 0.12 lbs NO2/million Btu. This represented a 94% reduction from single-stage operation at 102% of stoichiometric oxygen. Since the gas cooling rate in the experimental unit was higher than projected for a commercial plant, it is expected that a commercial plant would experience even lower nitrogen oxide emissions. A mathematical model using the Zeldovich mechanism was adequate to follow the NOx decomposition in the air-rich system; an extended Zeldovich was more appropriate in the fuel-rich regime. Experiments showed that at high slag-rejection rates of greater than 90% recovery of the potassium used by aqueous extraction was better than 99%. Cost estimates of a 1000 MWe MHD-steam plant, in which the spent seed is recovered by aqueous extraction and then regenerated with reducing gases to remove the sulfur, showed an operating cost of the seed recovery-sulfur removal steps of 9% of the overall power costs of 9.1 mills/kwh. (Author abstract)

34954 **APTIC NO. 57682**

Chappell, Gilford A.

DEVELOPMENT OF AQUEOUS PROCESSES FOR REMOVING NOX FROM FLUE GASES - ADDENDUM. *Esso Research and Engineering Co., Linden, N. J., Government Research Lab., Environmental Protection Agency Contract 68-02-0220, Program Element No. 1A2014, EPA-R2-73-051a, 29p., June 1973. 2 refs.*

NTIS: PB 226512/AS

Findings of a laboratory program for the development of aqueous processes for removing nitrogen oxides and sulfur dioxide from combustion flue gases are summarized. Analytical techniques and scrubber design are discussed, and experimental results obtained with a vertical spray tower scrubber are presented. The scrubbing experiments indicated the following: nitrogen dioxide and SO_2 are effectively absorbed by 1.0 molar sodium sulfide (Na_2SO_3) solutions; NO_2 absorption by 1.0 molar sodium hydroxide solution is enhanced by the presence of SO_2 in the flue gases; neither nitric oxide nor NO_2 is effectively absorbed by 1.0 molar NaOH solution in the absence of SO_2, and NO absorption is not improved by the presence of SO_2; increasing the weight ratio of liquid flow rate to gas flow rate improves NO_2 and SO_2 absorption by 1.0 molar Na_2SO_3; and under similar scrubbing conditions magnesium hydroxide slurry is not as effective as Na_2SO_3 solution for NO_2 absorption. The data also indicated that sulfite solutions will effectively absorb NO_x and SO_2 from flue gases provided that the NO_x (mostly NO) is oxidized to NO_2 upstream from the scrubber. (Author abstract modified)

34955 **APTIC NO. 58331**

Conrad, G.

PRIMARY CRUSHING AND DRYING IN AN IMPACT DRIER WITH THE AID OF ROTARY-KILN WASTE GASES. *(Die Vorzerkleinerung und-trocknung im Prallbrecher mit Drehofenabgasen). Text in German. Zement-Kalk-Gips (Weisbaden), 26(11):540-542, 1973.*

The waste gases from rotary kilns with a temperature of 330 C must be utilized for improving the economy of the kilns and for improving the efficiency of dust removal. The impact drier is a suitable consumer of such waste gases, particularly if it is directly combined with the following grinding equipment. Through preliminary heating of the grinding material the efficiency and capacity of the mill can be increased and energy can be saved. Experience has shown that it is better to draw all kiln waste gases through the drier and put up with an unfavorable heat balance as long as the temperature of the drier and mill waste gases remains between 130 and 150 C because this guarantees that the legal requirements concerning dust removal can be met.

34956 **APTIC NO. 57780**

Cover, A. E., W. C. Schreiner, and G. T. Skaperdas

THE KELLOGG COAL GASIFICATION PROCESS SINGLE VESSEL OPERATION. *Preprint, Inst. Gas Technol., Chicago, Ill. 12p., 1973. 5 refs. (Presented at the IGT Clean Fuels Coal Symp., Sept. 11, 1973.)*

A modification of the Kellogg Coal Gasification Process has been achieved by eliminating the separated combustor and injecting oxygen, together with steam and coal, directly into the gasification vessel to supply the necessary heat autothermally. The advantages of the process include the ability to handle caking coals without pretreatment, complete gasification of all tar components, minimization of methane formation, and independent control of residence time and temperature. The total capital requirement for a plant producing 250 times 10 to the 9 Btu/day is estimated at $272,000,000, and the twenty-year gas selling price is estimated to be $1.01 per million Btu. Work is ongoing to demonstrate both the reactor mechanical design features and materials of construction in a corrosion test vessel. (Author abstract modified)

34957 **APTIC NO. 58160**

Davey, T. R. A.

THE SULPHUR PROBLEM AND THE NON-FERROUS METALS INDUSTRY IN AUSTRALIA. PART II. SULPHUR RECOVERY PROCESSES. *PACE, 26(9):9-11, Sept. 1973. 20 refs.*

Australia has sufficient sulfur from indigenous sources to be more than self-sufficient, but the relative economics of producing sulfuric acid from these sources, or from imported sulfur, including the high costs of transporting H_2SO_4 from potential sites of production to places of consumption, together with the low prices of elemental S in oversupply in the world, dictate that about half of Australia s present H_2SO_4 production comes from imported S. Australia s present sulfur dioxide emissions are negligible in total, compared with those of northern hemisphere countries. Where dispersion by high stacks is not practicable, SO_2 should be removed from stack gases to keep ground concentrations at acceptable limits. Technologically, this is now possible. Some modification of the free economic conditions would be necessary to bring about the condition when all Australia s requirements of sulfur are met from indigenous sources, by recovery from stack gases, or by commercial development of metallurgical techniques which produce elemental S rather than SO_2. Techniques of fossil fuel desulfurization and by-product recovery of SO_2 from stack gases are discussed. (Author conclusions modified)

34958 **APTIC NO. 58253**

Dawson, D. W., K. A. Hanson, and R. C. Holder

LOW NOX EMISSION COMBUSTOR DEVELOPMENT FOR AUTOMOBILE GAS TURBINE ENGINES. *AiResearch Manufacturing Co. of Arizona, Phoenix, Ariz., Environmental Protection Agency Contract 68-04-0014, APTD-1374, 269p., Feb. 1973.*

NTIS: PB-225133/8AS

An analytical model to predict the formation of the trace species nitric oxide and nitrogen dioxide for a specified two-dimensional flow field in a gas turbine combustor was formulated and programmed. A variety of combustor configurations were rig tested, including vaporizers, atomizers, radiant, pneumatic impact and premix combustors. Both an atomizer combustor and a vaporizer combustor with various recuperator bypass ratios were tested in an engine. Significant test conclusions were identified and discussed. The goal of demonstrating emissions (nitrogen oxides, hydrocarbons, and carbon monoxide) lower than the 1976 Federal Emission Standards for Light Duty Vehicles was met, except for NO_x, when utilizing simulated Federal Driving Cycle procedures. A design technique that achieved significant NO_x reductions in a gas turbine combustor was demonstrated. This technique involved the application of recuperator (or regenerator) bypass air directly into the combustor primary zone. (Author summary modified)

34959 **APTIC NO. 57968**

Feazel, Charles E. and Sabert Oglesby, Jr.

EVOLUTION OF THE ELECTROSTATIC PRECIPITATOR. SEVENTY YEARS OF RESEARCH AND DEVELOPMENT. *Bull. S. Res. Inst., 26(1):14-18, Summer 1973. 40 refs.*

The history of electrostatic (Cottrell) precipitators is presented. Over the past 70 years, improvements have been made in components such as electrical power supplies; however, in terms of design practice, there is still considerable reliance on analogy or empirical methods for determining precipitator size to achieve a given level of performance. As a result, precipitators have been undersized in many installations. These empirical methods of design will become even more inadequate in dealing with the increasingly stringent requirements for air pollution control that can be expected in the future. However, research is being aimed at a more fundamental understanding of precipitator technology and promises to improve design procedures.

34960 **APTIC NO. 58784**

Fleming, R. D. and J. R. Allsup

NATURAL GAS AS AN AUTOMOTIVE FUEL, AN EXPERIMENTAL STUDY. *Bureau of Mines, Bartlesville, Okla., Bartlesville Energy Research Center, Rept. Invest. 7806, 26p., 1973. 12 refs.*

GPO

Natural gas was evaluated as an automotive fuel, and guidelines were developed for optimum engine adjustments for low exhaust emissions. The study was conducted using a single-cylinder engine, a multicylinder engine, and a total of eight vehicles. Results from single-cylinder engine tests showed that the light-load, lean-limit misfire region for natural gas begins at an air-fuel ratio between 150 and 160% of stoichiometric. Changes in ignition timing significantly influenced emissions of nitrogen oxides and hydrocarbons, but had little effect on carbon monoxide emissions. Low emissions can be achieved with current-design engines via the adjustment of engine parameters, but only with heavy penalty to engine performance. Emissions from vehicles fueled with natural gas are virtually unaffected by ambient temperature changes within the range 20 to 100 F. The organic emissions from engines fueled with natural gas were estimated to be 22 to 25% as reactive as the emissions produced using gasoline. The levels of exhaust emissions from vehicles fueled with natural gas were unchanged over 10,000 miles of normal driving. (Author abstract)

34961 **APTIC NO. 57927**

Hall, R. E., J. H. Wasser, and E. E. Berkau

A STUDY OF AIR POLLUTANT EMISSIONS FROM RESIDENTIAL HEATING SYSTEMS. *National Environmental Research Center, Research Triangle Park, N. C., Control Systems Lab., 1AB014, 21 ADG-AO, EPA-R2-73-, 124p., July 1973. 14 refs.*

Recent Environmental Protection Agency research work on air pollutant emissions from small scale combustion systems is summarized. Major factors for controlling emission levels are excess air, residence time at high temperature, combustion air handling components of burners, and burner maintenance. Carbon monoxide, gaseous hydrocarbons, smoke, and particulate emissions pass through a minimum point as excess air is increased from stoichiometric. Nitrogen oxides pass through a maximum point when excess air is increased. Flame retention can be used both to reduce total emissions and to increase furnace efficiency. Combustion improving devices, other than one utilizing flame retention, have little effect on pollutant emisison levels. Burner and furnace maintenance affect burner performance and emission levels. Ignition systems, nozzles, and combustion chamber shape and material are less significant variables in the control of air pollutant emissions. Nitrogen oxides were the only pollutant affected by ignition systems. Nozzles have a small effect on emissions of smoke, gaseous hydrocarbons, carbon monoxide, nitric oxide, and carbon dioxide. Combustion chamber material affects all emissions. Future work directed toward reduction of emissions is outlined. (Author summary modified)

34962 **APTIC NO. 58875**

Hangebrauck, R. P.

ENVIRONMENTAL CONTROL COAL RESEARCH IN EPA. *Preprint, National Coal Assoc., Washington, D. C., 6p., Oct. 1973. (Presented at the International Coal Research Conference, 1st.)*

Programs being conducted by the Environmental Protection Agency aimed at solving environmental problems associated with the needed acceleration of coal use are outlined. Flue gas cleaning programs have been an area of major concentration and have encompassed those of the throwaway and regenerable types. The former are typified by the limestone scrubbing and double alkali processes, while the latter include the Mag-Ox, Wellman-Lord, Cat- Ox, and Stone and Webster/Ionics processes. Activities are also being concentrated on the development and demonstration of control capabilities for fine particulates based on modifications to conventional systems such as electrostatic precipitators, fabric filters, scrubbers, and novel devices as well. A program in coal cleaning has been conducted in three areas: physical coal cleaning, chemical coal cleaning, and utilization of the rejects from coal cleaning to enable the optimization of such plants and the conservation of energy and sulfur values in the rejects. Combustion modifications for oxides of nitrogen control are also being developed, and a major effort in the study of new combustion processes has gone into fluid bed combustion. Advanced power cycles are also being considered. The Agency has also undertaken a program to determine potential environmental problems associated with effluents from fuel conversion systems.

34963 **APTIC NO. 55715**

Heeren, Hermann

ENVIRONMENTAL PROTECTION THROUGH DRY COOLING IN POWER PLANTS. *(Umweltschutz durch Trockenkuehlung fuer Kraftwerke). Text in German. Umschau (Berlin), 73(21):672-673, 1973. 2 refs.*

Dry cooling using air-cooled elements offers a feasible solution for controlling waste heat. Direct and indirect methods of dry cooling are described. The latter concept is being promoted; the steam is exhausted by the turbine and condenses in a spray condenser. This is connected in a closed water circuit from which the heat is recovered by means of water to air heat exchangers. An improved version of this system is discussed where a refrigerant is used in the primary circuit. This system lends itself especially to nuclear power applications.

34964 **APTIC NO. 57931**

Pengidore, D. A.

ENCLOSED COKE PUSHING AND QUENCHING SYSTEM DESIGN MANUAL (FINAL REPORT). *National Steel Corp. Weirton, W. Va., Weirton Steel Div., Environmental Protection Agency Contract 68-02-0622, Proj. 1AB013, Rept. EPA-650/2-73-028, 95p., Sept. 1973.*

NTIS: PB 226418/AS

A new concept in abating air pollution normally associated with coke pushing and quenching emissions in the iron and steel industry is described. The enclosed coke pushing and quenching system involves containment of the hot coke from the face of the slot-type oven during the pushing operation, through the successive handling and transport, and through a continuous and controlled quench. The hot coke emissions are confined and cleaned before discharge to the atmosphere and the quench emissions are controlled to stack discharge of low-velocity steam vapor. The coke plant itself consists of a single battery of 87 tall ovens and complete coal chemical plant and support facilities. Control equipment includes hoods, venturi scrubbers, spray towers, a recirculation system, and the entire apparatus is a closed system. (Author abstract modified)

34965 **APTIC NO. 58120**

Prather, Robert J., Siichi Miyamoto, and Hinrich L. Bohn

NITRIC OXIDE SORPTION BY CALCAREOUS SOILS: I. CAPACITY, RATE, AND SORPTION PRODUCTS IN AIR DRY SOILS. *Soil Sci. Soc. Am. Proc., 37(6):877-879, Nov./Dec. 1973. 13 refs.*

At room temperature, air dry calcareous soils sorbed from 0.5% to 2% nitric oxide by weight within 10 to 15 min from a dry air stream containing 1.6% NO by volume. The sorption capacity increased with 0.4 to 0.7-th power of NO concentration and the soil specific surface and was independent of the soil acid-titratable basicity. The sorption rate was approximately proportional to the unused portions of the capacity with rate constants ranging from 0.4 to 1/min. Less than 10% of sorbed NO was lost by heating at 105 C or a suction of 65 cm mercury for 24 hr. The NO sorbed by the soil was converted to nitrate ion. (Author abstract)

34966 **APTIC NO. 58121**

Prather, Robert J., Seiichi Miyamoto, and Hinrich L. Bohn

SORPTION OF NITROGEN DIOXIDE BY CALCAREOUS SOILS. *Soil Sci. Soc. Am. Proc., 37(6):860-863, Nov./Dec. 1973. 11 refs.*

The nitrogen dioxide sorption capacity and rate of calcareous soils, a calcic soil, and a granular limestone were measured at room temperature by passing air or nitrogen gas containing NO2 through them. In dry air (humidity less than 5%), NO2 sorption reached an equilibrium value within 2.5 min. In moist air (humidity greater than 95%), NO2 sorption increased as much as 10 times that in dry air and approximately equaled the acid titratable basicity of calcareous soils. The sorption rate was proportional to the unreacted fraction of the capacity with sorption rates constants ranging from 0.015 to 0.03/min at a NO2 concentration of 0.5% volume. At a concentration of 0.1%, the sorption rate was slower but the capacity remained unchanged. Sorption of NO2 was similar when either air or a nitrogen carrier was used. (Author abstract)

34967 **APTIC NO. 57872**

Stafford, Ronald G.

COMPARATIVE EVALUATION OF SEVERAL GLASS-FIBER FILTER MEDIA. *California Univ., Los Alamos, N. Mex., Los Alamos Scientific Lab., Atomic Energy Commission Contract W-7405-Eng. 36, UC-41, 5p., June 1973. 10 refs.*

NTIS: LA-5297-MS

Several types of glass fiber filter media were evaluated for dioctyl phthalate (DOP) smoke penetration and filter pressing drop. The results were compared to previous MIL-F-51079 specification tests performed at the Naval Research Laboratory (NRL) on the same media. The DOP smoke penetration and pressure drop were lower than that reported by NRL. Density corrections were valid experimentally at velocities below 25 cm/sec and application of these corrections lead to better agreement between the two laboratories; however, results are not entirely consistent. All media met the MIL-F-51079 specifications for the two parameters evaluated. (Author abstract modified)

34968 **APTIC NO. 58119**

Whitmore, P. J. and A. Meisen

DIFFUSIOPHORESIS UNDER TURBULENT CONDITIONS. *J. Aerosol Sci., 4(6):435-446, Nov. 1973. 11 refs.*

Diffusiophoretic separation of 0.79 micron latex aerosols from nitrogen-ammonia mixtures was studied under turbulent conditions. The experiments were conducted with a small wetted wall column in which the gas mixture flowed countercurrently to a descending water film. The measured particle removal efficiencies are compared with theoretical predictions based on the hypothesis that the radial particle velocity is given by the mean molar velocity of the gas mixture, the mean mass velocity of the mixture, or Schmitt and Waldmann s (1960) expression. The theoretical efficiencies are only functions of the molecular weights and terminal concentrations of the gaseous species and the second hypothesis is in best agreement with experimental data. Diffusiophoresis under turbulent conditions requires large changes in gas composition to achieve even moderate particle removal efficiencies.

34969 **APTIC NO. 58161**

Zalogin, N. G.

REMOVAL OF SULPHUR OXIDES FROM FLUE GASES BY POWDERED LIMESTONE. *Thermal Eng. (English translation from Russian of: Teploenergetika), 20(1):46-50, Jan. 1973. 8 refs.*

The process of sulfur oxide removal from flue gases by use of powdered limestone as an absorbent has been examined and found to be the simplest method practicable since it does not require any additional equipment for preparing the absorbent or for removing wastes formed. The main shortcoming of the method is the low intensity of the reaction between gaseous sulfur dioxide and the powdered calcium oxide. Cost of the process might be reduced by increasing the degree of fineness of the CaO, partial recirculating of the unused CaO, increasing the time of contact of the gases with CaO at a temperature for maximum reaction intensity, and finding methods for the most efficient use of the wastes.

34970 **APTIC NO. 58713**

MAZDA FROM TOYO KOGYO IN GERMANY. *Automobiltech. Z. (Stuttgart), 75(10):387-389, 25-27, 1973.*

Various new models of the Wankel-engine equipped Mazda are described. The Wankel engine supplied today is modified to meet the prevailing 1975 U. S. exhaust emission limits. The main emission control equipment includes a thermal reactor for afterburning of the gases after secondary air has been injected, the control system for the supply of air, and a variable ignition system for the lagging plug. The test by the U. S. Environmental Protection Agency applied to the model RX-3 after 80,000 km gave following results: the CO concentration was 1.79 g/mi, the hydrocarbon concentration 0.21 g/mi, and the oxides of nitrogen concentration 0.99 g/mi.

34971 **APTIC NO. 58214**

North Atlantic Treaty Organization/Committee on the Challenges of Modern Society, Expert Panel for Air Pollution Control Technology and Research Triangle Inst., Research Triangle Park, N. C.

AIR POLLUTION. CONTROL TECHNIQUES FOR NITROGEN OXIDE EMISSIONS FROM STATIONARY SOURCES. N. 20 (FINAL REPORT). *[illegible]42p., Oct. 1973. 169 refs.*

GPO

A compendium of information on methods for the control of nitrogen oxide emissions was assembled based on the Environmental Protection Agency s Control Techniques for Nitrogen Oxide Emissions from Stationary Sources. Consideration is given to such processes as electric power plant boilers, domestic and commercial heating, incineration, chemical processing, petroleum refining and production, pig iron and steel production, and other miscellaneous emission sources. Control techniques discussed include: combustion process modification and various gas cleaning processes such as scrubbing and catalytic reduction. Emission factors are provided for nitrogen oxide sources.

34972 **APTIC NO. 58224**

North Atlantic Treaty Organization/Committee on the Challenges of Modern Society, Expert Panel for Air

Pollution Control Technology and Research Triangle Inst., Research Triangle Park, N. C.

AIR POLLUTION. CONTROL TECHNIQUES FOR SULFUR OXIDE AIR POLLUTANTS. N.12. (FINAL REPORT). *235p., Oct. 1973. 316 refs.*

GPO

A compendium of information on methods for the control of sulfur oxides was assembled based on the Environmental Protection Agency's Control Techniques for Sulfur Oxide Air Pollutants. Industrial processes considered include: nonferrous primary smelters, petroleum refineries, sulfuric acid plants, iron and steel plants, pulp and paper mills, solid waste and sewage disposal, and other miscellaneous sources including food operations. Control methods described include: energy source substitution, energy resource conservation, fuel desulfurization, and stack gas desulfurization processes. Sulfur oxide dispersion from stacks and emission factors are also considered.

34973 **APTIC NO. 58235**

North Atlantic Treaty Organization/Committee on the Challenges of Modern Society, Expert Panel for Air Pollution Control Technology

AIR POLLUTION. CONTROL TECHNIQUES FOR HYDROCARBON AND ORGANIC SOLVENT EMISSIONS FROM STATIONARY SOURCES. N. 19. (FINAL REPORT). *125p., Oct. 1973. 104 refs.*

GPO

A compendium of information on methods for the control of hydrocarbon and organic solvent emissions has been assembled based on the Environmental Protection Agency's Control Techniques for Hydrocarbon and Organic Solvent Emissions from Stationary Sources. Industrial sources considered include: petroleum refineries; gasoline distribution systems; chemical plants; paint, lacquer, and varnish manufacture; rubber and plastic industries; surface coating applications; degreasing operations, dry cleaning; textile industries; metallurgical coke plants; sewage treatment; waste incineration; and other miscellaneous industrial sources. Control techniques described include: use of afterburners, flares, and incineration; adsorption; absorption; condensation; packed fiber beds; odor control; process modification; and material substitution.

1972

34974 **APTIC NO. 58295**

Baron, S.

FUEL CELL POWER GENERATION AND GASIFICATION. *Preprint, Oklahoma State Univ., Stillwater, 22p., 1972. 5 refs. (Presented at the Frontiers of Power Technology Conference, Stillwater, Okla., Oct. 1972, Paper 12.)*

The comparative advantages of fuel cells with proven and developmental power generation and methods (including steam plants, MHD plants, solar plants, and nuclear power plants) are discussed. These methods are presented in a table and compared by efficiency, air pollution, thermal effects, energy reserve, development costs, capital costs, operating costs, and ease of siting. The ideal fuel for fuel cells is hydrogen which can be obtained during the gasification of fuels such as distillates and coal. Types of fuel cells and power plant applications are discussed. There are many features of the fuel cell power plant that make them particularly attractive to the utility industry, especially in light of present environmental concerns and increasing costs. Since clean fuels are used in the cells, the reaction products are essentially water and carbon dioxide with small amounts of hydrogen, carbon monoxide, and nitrogen. Experimental fuel cells give off 0-0.00026 lbs of pollutants/1000 kwh, 0.139-0.236 lbs nitrogen oxides, 0.225-0.031 lbs HC, and 0.00003.0 lbs particulates, which is far less than the amounts given off by gas-, oil-, and coal-fired utilities. The heat generated by the fuel cells can be recovered in the gasification step, or the product gases from low temperature cells can be cooled in air condensers for recovering the water. The elimination of air and thermal pollution and the low noise level permit the plants to be located near the load centers, thereby reducing transmission costs associated with present day power plants which are sited near large water sources.

34975 **APTIC NO. 57826**

Carden, Philip

NEW STEELMAKING PROCESS GIVES LOW ENVIRONMENTAL POLLUTION. *Steel Times (London), 200(3):297-303, March 1972.*

A new two-stage steelmaking process developed at the Haellefors steelplant of SKF Stal which utilizes a melting and refining process appears to offer less potential for emission and much higher utilization of electric power and equipment than conventional electric arc furnace methods. The furnace differs from conventional electric arc furnaces in that it has two shells fitted with swinging roofs. Smelting takes place in one furnace shell, while all other operations are carried out in the other shell. The low level of environmental pollution from the equipment is mainly due to the construction and application of the exhaust gas-cleaning system with which the twin-shell furnace has been provided, and also the way in which the process is conducted. The equipment consists of two wet scrubber aggregates of the venturi type, one of which is attached to the side of each shell. Gas preheating gives less dust. The dust level is one-tenth that of conventional electric arc furnaces with a cleaning system. Measurements of the amount of particulate matter in the exhaust gases released to the atmosphere have given a value of 0.15 kg/ton of raw steel. The system offers not only investment advantages but also lower power costs.

34976 **APTIC NO. 57801**

Clark, T. M.

AUSTRALIAN EXPERIENCES IN COAL DUST SUPPRESSION. *Ann. N. Y. Acad. Sci., vol. 200:797-807, 1972. 12 refs.*

Australian experiences in coal dust suppression are reviewed along with current dust standards and sampling techniques. Criticisms of present standards are that they are based on a number count rather than mass and that they are based on the free silica content of the material being worked rather than on the content of airborne dust. Efforts are being made to correlate test results from gravimetric samplers which appear excellent for use in static locations with those of the Owens Jet Instrument, and thus far correlations of 0.92 and 0.82 have been attained for two separate districts. Ventilation and water spraying have been found essential in the control of dust. Studies performed on the position of the workman relative to the position of the front of the brattice or intake to the tubing have shown that the best locations are behind the front of the tubing or brattice and on the side of the machine remote from the tubing or brattice. Both face fans and brattice are used in the more dusty mines with equal effectiveness. Water sprays are usually fitted to face machines when purchased, but for local conditions, additional sprays are essential. Sprays are directed toward the cutting head and gathering arms, into the throat of the machine, and onto the scraper conveyors for continuous miners. Sprays are used on conveyor systems where necessary, such as at change points and bin dischargers. Roadway consolidation by means of treatment with hygroscopic salts helps keep intake counts low. Approved types of respirators are also required in some areas.

34977 **APTIC NO. 57032**

Drion, J., S. Carpentier, G. Chevalier, R. Delarue, J. Pradel, and P. Zettwoc

CLEANING OF INDUSTRIAL WASTE FROM INCINERATOR GASEOUS EFFLUENTS. CASE OF TIRES. *(Epuration des effluents gazeux d incinerateurs de dechets industriels. Cas des pneumatiques). Cong. Int. Genie Chim. Serv. Homme, Paris, France, 1972. (Sept. 3-9.) Translated from French, 12p.*

A review of the destruction of urban industrial waste by incineration is presented, and an automatic incinerator for the combustion of used tires is described which has been designed to avoid all atmospheric pollution. The incinerator is designed to handle 150 kg/hr of tires ranging in dimensions up to 900 mm in diameter and 200 mm in width. The incinerator achieves complete combustion of both the carbon black used as filler in tire manufacture and that produced by the combustion of rubber. A patented forced draft furnace with lateral tuyeres, a combustion chamber with strong turbulence resisting from the mixing air tuyeres, a very high efficiency post-combustion chamber, and an automatic loading device which introduces each tire only when the combustion of the preceding has sufficiently advanced to avoid overloading of the furnace and the post combustion chamber are incorporated. The gases leave the post combustion chamber at about 1000 C, are cooled down to 350 C by air mixture via an automatically regulated diluting apparatus, are picked up by a blower-extractor, and evacuated to a chimney. The essential component of the gas purification system is the post-combustion chamber.

34978 **APTIC NO. 55510**

Farmery, Keith, Alan Kay, and Teesside Norton-Hall

CATALYTIC TREATMENT OF EXHAUST GASES FROM COMBUSTION ENGINES. *(Verfahren zur katalytischen Behandlung von Abgasen von Verbrennungsmotoren). Text in German. (Imperial Chemical Industries, Ltd., London (England)) W. Ger. Pat. Appl. 2,222,467. 15p., May 8, 1972. 4 refs. (10 claims).*

A two-stage catalytic treatment of exhaust gases from combustion engines is described. The reactor contains an oxidation catalyst (palladium) to reduce free oxygen to 0.15% with space velocities of 0.15-3.00.10 to the 5th power/jr and a catalyst volume of 0.02-0.2 times the volume of the second catalyst, when both have the same physical form. The second step uses nickel or cobalt at 700 degrees, or rubidium at 300-700 degrees.

34979 **APTIC NO. 57809**

Goldfeder, Louis B.

CONTROL VALVES FOR LNG FACILITIES. *Pipeline Gas J., 199(1):58, 62, 66, 67, 72, 74, Jan. 1972.*

Selection and application of control valves for gas purification, liquefaction, and vaporization/storage are reviewed for liquefied natural gas facilities. Gas purification, or pre-treatment, which involves a dehydration system for moisture, carbon dioxide, and glycol removal typically requires automatic control valves that are capable of operating against high pressure and temperature differentils; valves with cage-style trim are particularly suited to such applications. The use of weld-end connections in cryogenic applications eliminates possible line flange leakage and sacrifices only the ease of replacing the valve body. Acceptable gasket materials include TFE, spring-loaded TFE, Kel-F, filled TFE, and TFE/stainless steel (spiral wound). Standard control valves for the liquefaction area include such types as the globe, ball, butterfly, Y-pattern, and split valve. The ball valve lends itself to gas vaporization applications due to its inherent characteristics of high flow with minimum pressure drop.

34980 **APTIC NO. 58812**

Hardy, Louis and Jean Andre Traviere

CATALYSTS FOR THE PURIFICATION OF GASES. *(Katalysator zum Reinigen von Gasen). Text in German. (EL-BAS. A. La Courneuve, Frankreich (West Germany)) W. Ger. Pat. Appl. 2,235,391. 15p., July 20, 1972. (11 claims).*

The preparation of catalysts for the purification of gases is described. Catalysts of high efficiency in the carbon monoxide removal from gases and of high AcOH adsorptivity containing nickel oxide or cobalt oxide promoter 63, vanadium oxide, uranium oxide.2water, or thorium oxide 12-18%, and alumina 18-24% are described. The catalysts were made by reaction with the metallic promoter with both the other components in a reducing atmosphere at a temperature below the reducing temperature of one of the three components. A catalyst (approximately 300 cu cm) was contacted with an air flow (4.5 l/sec) containing 200 ppm CO to give a CO removal of 88, 97, and 99% at 100, 150, and 200 degrees respectively. The AcOH adsorptivity was 10.9% with respect to the catalyst weight at 17 degrees.

34981 **APTIC NO. 55909**

Isahaya, Fumio

REMOVAL OF SULFUR DIOXIDE FROM FLUE GAS. *(Abgas-Reinigungsanlage). Text in German. (Hitachi Ltd., Tokyo (Japan)) W. Ger. Pat. Appl. 2,244,140. 14p., Sept. 8, 1972. (4 claims).*

The removal of sulfur dioxide from flue gas is described. The SO2 (90%) was removed from 180 degrees hot flue gas containing 1500 ppm SO2 by pneumatic spraying of 0.04 l, 10% sodium hydroxide/cu m with compressed air through a 2 fluid spray nozzle with opening diameter 0.5 mm (semi-wet process) in a reaction tower in countercurrent to the flue gas. Solid particles containing 90% sodium sulfite and 10% sodium carbonate were formed. The spray openings were arranged at such angles that the mist droplets of 40 micron diameter did not collide with the wall and each other.

34982 **APTIC NO. 57797**

Johnson, A. R., W. Volk, and H. O. Johansson

PRODUCTION OF DIRECT MELTING PYROPHORIC IRON FROM STEEL MILL WASTES AND COKE OVEN GAS. *Preprint, American Chemical Society, 12p., 1972. 6 refs. (Presented at the American Chemical Society, National Meeting, Boston, Mass., April 13, 1972.)*

A series of experiments are described during which pyrophoric iron and its handling procedures were studied. When pyrophoric iron is exposed loosely to air with unlimited amounts of oxygen, it oxidizes with liberation of heat; therefore it must be carefully handled. Passivation of pyrophoric sponge iron has been accomplished by heating H-Iron product to an elevated temperature. Briquetting and heating of pyrophoric H-Iron is also a method of coping with the rapid reoxidation problem. Hydrocarbon Research, Inc., was interested in bypassing the passivation step and therefore experimented with direct feeding of pyrophoric powder to electric furnaces. If H-Iron technology is used, coke is not required as a reductant, and therefore, particulate and noxious fume release during charging and discharging of the coke ovens is eliminated. Dust from basic oxygen and blast furnaces is collected and recycled as feed to the H-Iron plant. Filter cake from scrubbers is recycled as feed. Flux materials such as limestone are not required and therefore, pollution from limestone mining an/ handling is eliminated. Waste disposal from a typical integrated steel mill was studied; total waste oxides amounted to 840,000 tons/yr and consisted of pellet chips, basic oxygen furnace dust, mill scale, and blast furnace dust. These wastes can be fed to an H-Iron plant to transform the waste disposal problem into an economic opportunity. Hydrogen required for the reduction of steel mill wastes can be produced using coke oven gas which is usually available in the steel mill. Operating costs for an 800,000 TPY plant producing hydrogen via particle oxidation of coke oven gas are equal to $11.30/ton of product. Total erected plant cost is estimated at $26,900,000.

34983 APTIC NO. 58227

Keairns, D. L.

FLUIDIZED BED GASIFICATION AND COMBUSTION FOR POWER GENERATION. *Preprint, Oklahoma State Univ., Stillwater, 36p., 1972. 22 refs. (Presented at the Frontiers of Power Technology Conference, Stillwater, Okla., Oct. 1972, Paper 11.)*

New power plants utilizing fluidized bed combustion and gasification of fossil fuels or low grade fuels at elevated pressure have the potential to meet sulfur dioxide, nitrogen oxide, and particulate abatement goals at reduced energy cost. Four fluidized bed fuel processes which show economic, fuel conservation, and environmental advantages were studied: coal gasification, fluidized bed combustion and oil gasification at elevated pressure with combined cycle generation, and oil gasification at atmospheric pressure to produce a clean boiler fuel. The processes of coal and oil gasification in fluidized beds and fluidized bed combustion are discussed, and plant design is described. Sulfur dioxide reductions of 95%, nitrogen oxide reductions of 80-90%, and particulate reductions greater than 99% can be achieved. Energy costs may be 10% less than conventional plants with stack gas cleaning using state-of-the-art power generation equipment. Plant efficiencies of 38-40% can be achieved with current power generation technology. Regeneration and recycle of the limestone/dolomite absorbent will probably be required for effective operation of fluidized bed power plants to avoid solid waste disposal problems. Second generation fluidized bed fuel processing plants may reach 50% efficiency for gasification and 45% for fluidized bed combustion.

34984 APTIC NO. 55549

Kudo, Shigeru, Shin Kawada, and Shigekazu Nishimoto

ODOR CONTROLLED KRAFT RECOVERY. *(Kaishu boira no oda contororu). Text in Japanese. Kami-Pa Gikyoshi (J. Japan. Tech. Assoc. Pulp Paper Ind.), 26(4):157-163, April 1972. 4 refs.*

The principles, the working, and the history of the odor control unit for the kraft recovery boiler are discussed. The odor control unit eliminates the direct control evaporator odor, and with the supply of a satisfactory amount of air, the combustion of hydrogen sulfide in the furnace is reduced to several ppm. The odor control unit and problems in its design are discussed. Furnace size, excess heater, boiler, fuel economizer, supply water temperature, and flue gas temperature were all given special consideration. The flue gas temperature is designed for 185-200 C, and this in combination with the lack of a direct contact evaporator (which collected 15-30% of dusts from the boiler) requires a particularly powerful electrostatic precipitator. The direct contact evaporator absorbed most of sulfur dioxode, especially when a venturi evaporator was used. With the odor control unit, SO2 emissions are about 50-200 ppm, even after sulfur is recovered in the form of smelt, reacting to sodium in black liquor. An overall comparison of the use of the Odor Control Unit compared to the Direct Contact Evaporator shows the superiority of the former, especially in its complete control of the characteristic odor of kraft pulp. The running cost is slightly higher. The specifications of the unit at the Akita Plant are presented.

34985 APTIC NO. 57793

Legatski, L. Karl and Jack D. Brady

CONTROL OF DUST FROM CONTINUOUS COAL MINING MACHINES. *Ann. N. Y. Acad. Sci., vol. 200:747-764, 1972. 9 refs.*

Basic dust collection mechanisms were reviewed, size distribution and loading of respirable coal mine dust was examined, and performance tests on various commercially available scrubbers and collectors were conducted in an effort to find an existing dust collector that would reduce the dust generated by continuous coal mining machines to the required level. The study indicated that no commercially available equipment exists that will immediately fit the physical constraints of the mine environment. The state-of-the-air knowledge of dust collection mechanisms was, however, found sufficient to serve as a basis for design of a dust collection system. The results further indicated that a venturi scrubber operating with a pressure drop of about 20-25 in. of water would satisfy the collection criterion, assuming the estimates of dust loading and size distribution to be approximately correct. The only variables found necessary for specification were: the dust concentration, size distribution, particle density, and air flow to be treated. A knowledge of the surface properties or composition of coal was not found important within practical limits.

34986 APTIC NO. 58249

Miller, S. G. and R. D. Robuck

THE STRETFORD PROCESS AT EAST WILMINGTON FIELD. *J. Petrol. Technol., vol. 24:545-548, May 1972. (Presented at the Society of Petroleum Engineers Annual California Regional Fall Meeting, 42nd, Los Angeles, Calif., Nov. 4-5, 1971.)*

The Stretford Process, initially accepted for treating coke oven gas, reformed petroleum products, and effluents arising in the manufacture of certain industrial products, is also useful for handling the production of hydrogen sulfide resulting from waterflooding of oilfield gases. Feasibility studies indicated that the Stretford Process has a substantial advantage in both initial cost and operating cost, as well as in ease of operation. Application of the process to natural gas has indicated that where carbon dioxide to hydrogen sulfide ratios are high, where air content of the gas is low, where sulfur quantities are moderate, and where nonpollution features are desirable, the process may be appropriate for economic removal of sulfur from such gas.

34987 APTIC NO. 57799

Quarm, T. A. A.

ELEMENTAL SULPHUR RECOVERY IN COPPER SMELTING. *Mining Mag. (London), 126(4):287, 289, April 1972. 3 refs.*

Continuous smelting in three furnaces in series was assumed as part of a scheme considered for elemental sulfur recovery in copper smelting. The first step in sulfur recovery was to pass the gas (750 F) through a bed of bauxite catalyst to decompose carbonyl sulfide with concurrent partial removal of hydrogen sulfide by reaction with sulfur dioxide. Sulfur vapor was then seen as being recovered by passing the gas through a condenser that would cool it to 260 F. About 4 ton/hr of liquid sulfur would be collected, and about 14 times 10 to the 6 Btu/hr recovered in low-pressure steam. The gas from the sulfur condenser would then be passed through a second bed of bauxite catalyst in which further reaction between hydrogen sulfide and sulfur dioxide would occur after the gas was reheated to 400 F in a heat exchanger by gas leaving the carbonyl sulfide reactor. The sulfur vapor thus produced, nearly 3 ton/hr, would be separated from the gas stream in a second condenser that would probably be followed by an electrostatic precipitator to prevent the escape of sulfur mist. About 8 times 10 to the 6 Btu/hr would be recovered in low-pressure steam from the condenser. The study indicated that the cost of smelting with elemental sulfur removal would be $0.90/ton of concentrate higher than that of a conventional operation, i.e., $0.0014/lb of copper.

34988 **APTIC NO. 57802**

Rushton, J. D.

COLLECTION AND TREATMENT OF ODOROUS KRAFT MILL GASES. *Paper Trade J., 156(52):36-37, Dec. 18, 1972. (Summarized from a paper presented at the 1972 TAPPI Alkaline Pulping Conference.)*

Methods for the collection and treatment of odorous gases from kraft mills with batch and continuous digesters are reviewed. Emissions from the batch digester blow heat recovery system, digester relief gases, evaporator noncondensibles, and other sources such as the turpentine decanter and tall oil plant may be combined into one gas header and taken to a treatment system. Effective treatment methods for pulp mill emissions are: caustic scrubbing combined with incineration in a lime kiln, caustic scrubbing combined with combustion in an incinerator, and two stage scrubbing. The combined emissions can first be scrubbed with white liquor to remove hydrogen sulfide and methyl mercaptan. Combustion of the pulp mill components in the lime kiln oxidizes the odorous compounds to sulfur dioxide which may be recovered in over 50% quantity by adsorption on the lime or by absorption in a high energy venturi scrubber. Caustic scrubbing and combustion in an incinerator offer no such built-in method for recovery of SO2; and a primary fuel, such as natural gas, must be provided to assure complete combustion. Two-stage scrubbing may be employed by utilizing residual chlorine dioxide for the oxidation of dimethyl sulfide and dimethyl disulfide which are not removed by white liquor scrubbing.

34989 **APTIC NO. 55511**

Sanchez, Moises Gali and Heymann Clarke Duecker

CATALYSTS FOR TREATMENT OF AUTOMOTIVE EXHAUST GASES. *(Abgasentgiftungskatalysator). Text in German. (W. R. Grace and Co., New York) W. Ger. Pat. Appl. 2,233,187. 19p., July 6, 1972. (7 claims).*

The preparation of catalysts for treatment of automotive exhaust gases is described. The catalysts have good heat resistance and contain platinum or palladium and optionally cuprous oxide, chromium oxide, cobalt oxide, and nickel oxide on MgAl2O4 spinel pellets with a surface area of 7--9 sq m/g or a MgAl2O4 coated cordierite monolith as support. A synthetic automotive exhaust gas was passed over the catalyst which gave 90% conversion of carbon monoxide, hydrocarbons, and nitrogen oxides at 362, 478, and 422 degrees respectively.

34990 **APTIC NO. 57800**

Shah, I. S. and Robert H. Quig

CHEMICO-BASIC MAGNESIUM BASED SO2 RECOVERY SCRUBBING SYSTEMS. *Preprint, American Inst. of Chemical Engineers, New York, 30p., 1972. (Presented at the American Institute for Chemical Engineers National Meeting, 71st, Dallas, Tex., Feb. 20-23, 1972.) (Also: Am. Inst. Chem. Engrs. J., 69(127):84-85, 1973.)*

The use of magnesium oxide as an additive in a properly designed scrubbing system for the recovery of sulfur dioxide from stack gas is seen as having the following major advantages: 90% plus removal of SO2, a closed-loop recycle-regeneration system, the ability to divorce on-site SO2 removal operations from off-site recovery operations, location of SO2 recovery operations at one centralized facility in order to achieve the necessary economies of scale and high load factor operations, and the recovery of SO2 in the form of concentrated acid and/or elemental sulfur with the MgO regenerated for recycling back to the individual scrubbing systems. The range of investment required for power plant SO2 scrubbing disposal or recovery systems, including the MgO recycle process, appears to vary between $12 and $40/KW based upon return field costs and definitive studies. The higher figure tends to be for two-stage systems on coal-fired boilers and includes fly ash removal and induced draft fans which handle not only the scrubbing system draft but the boiler draft as well. The lower figure is related to oil-fired boilers.

34991 **APTIC NO. 57876**

Wells, Grant DeWitt

SIMULATION OF IN-HOUSE DRYING OF CHICKEN EXCRETA. *Michigan State Univ., East Lansing, Mich., Dept. of Agricultural Engineering, Thesis (Ph.D.), Ann Arbor, Mich., Univ. Microfilms, Inc. 1972, 157p. 44 refs.*

Ninety five samples of chicken excreta were dried in 11 laboratory controlled environments simulated to typify those found in poultry houses. Fresh chicken excreta contains 88% moisture on the wet weight basis. Partial drying of chicken excreta within a few hours after deposit reduces odor production considerably. Drying is a function of free stream velocity, wet bulb depression, and ambient air temperature as it affects the saturated vapor pressure. Process variables of increased surface area and conducted heat source also increased the drying rate. More than half of the removable moisture was evaporated from the body surface at constant rates which can be predicted by film resistance and concentration gradients. (Author summary modified)

34992 **APTIC NO. 58283**

Wilke, Dennis F., L. C. Davis, and Robert H. Borcherts

A DESIGN FOR A MAGNETICALLY LEVITATED HIGH SPEED VEHICLE. *Institute of Electrical and Electronic Engineers, New York, IEEE (Inst. Elec. Electron. Engrs.) Ind. Appl. Soc., Annu. Meet., 7th, Philadelphia, Pa., 1972, p. 333-336. 26 refs. (Oct. 9-12.)*

One of the most promising means of achieving a high magnetic suspension is to use superconducting magnets on a vehicle traveling over a conducting guideway. Active damping using feedback control of the currents in either the main support magnets or in separate control magnets is discussed as is passive damping using copper plates attached to the suspension magnets. A superconducting magnet design is discussed, and from this design the cryogenic refrigeration requirements and magnet lift/weight ratio are determined. The power and thrust specifications for the propulsion system, based on the requirements for air drag, magnetic drag, and acceleration capability, are presented. A peak in the magnetic drag force at speeds of about 10 mi/hr is characteristic of magnetic suspensions using eddy current repulsion, and the thrust required to move past this peak is probably prohibitively high. Ways of bypassing this drag peak are discussed. High clearance propulsion systems such as a linear synchronous motor may be desirable. The distribution of the weight among the various components required for suspension, control, propulsion, and the vehicle body, based on the designs discussed, are then presented. Finally, the guideway requirements are discussed. Dynamic analyses have shown that a guideway configuration which provides orthogonal surfaces for levitation and control is preferable for basic stability and ease of control.

34993 **APTIC NO. 57917**

Wolfson, D. E.

USE OF PREHEATED COAL IN CARBONIZATION. *Bureau of Mines, Pittsburgh, Pa., Pittsburgh Energy Research Center, RI 7630, 8p., 1972. 5 refs.*

The effect on the yields and quality of the product of preheating coal blends at 232 C (450 F) prior to carbonization at 900 C by the Bureau of Mines-American Gas Assoc. method was determined. The percentage of low-volatile coal in the blends was reduced from 20-15 to 10%. The largest improvement in the coke stability index as a result of preheating was achieved with the 10%-low- volatile blend, in which the tumbler stability index was increased from 40 to 48. Increasing the percentage of low-volatile coal to 15 and 20% in the preheated blends increased this index to 49 and 52 respectively. The stability index for the 20% blend of low-volatile coal on the as-received sample, which is currently being used at the National Steel Corp. plant, without preheating, was 50. All 1/4-inch tumbler indices were similar, ranging from 64 to 66. The liquor yield was decreased about 60% by preheating the coal prior to carbonization. The coking time for the as-charge blends was 11 hr, compared to 8.7 hr for the preheated blends, a reduction of about 20%. Preheating coal prior to carbonization should improve the economics of the oven operation. Preheating combined with a closed pipeline charging system would eliminate a major source of pollution from coke ovens. (Author summary)

1971

34994 **APTIC NO. 57926**

Ducsik, Dennis W., Larry Donovan, and Steven Milligan

CONTROLLING SULFUR OXIDE EMISSIONS. *In: Power, Pollution, and Public Policy, Massachusetts Inst. Technol., Cambridge, Mass., Sea Grant Project Office, National Oceanic Atmospheric Administration Grant GH-88, Sea Grant Program Rept. MITSG-71-8, Rept. NOAA-72022912-4, MIT Rept. 24, p. 187-241, June 1971. 48 refs.*

NTIS: COM-72-10398-4

The technology of sulfur oxide control, the supply and demand for sulfurized fuels, and schemes for collective action to control the emissions are examined. Sulfur oxide emissions can be controlled by sulfur dioxide removal from stack gases, desulfurization of fossil fuels, use of low sulfur fuel, use of nuclear or hydroelectric power, combustion of natural gas, the development of new energy related technologies, and the use of tall stacks for better atmospheric dispersion. The major alternative mechanisms of direct regulation and economic incentives that have been suggested to bring about effective air pollution control are reviewed. A most effective policy would be a strategy utilizing a fuel tax as a short term and emission fees in the long run. (Author abstract modified)

34995 **APTIC NO. 58231**

Jackson, Walter E.

ENVIRONMENTAL CONTROL. *In: Environmental Health. P. Walton Purdom (ed.), New York, Academic Press, 1971. Chapt. 8, p. 379-429. 18 refs.*

The application of engineering technology to environmental control is discussed including: heating, ventilation, and conditioning; adequate lighting, and noise evaluation and control. Air engineering deals largely with the concepts of air movement in occupied enclosures, and air transfer between the outdoor atmosphere and these enclosures. Significant air currents are created within enclosures by mechanical and thermal forces. The relation between this air motion and the desired goal of comfort and/or contaminant removal is illustrated. Exhausting of contaminated air is most effectively achieved by a mechanical system for local ventilation. Practical applications for general dilution ventilation are also described. Exhausted air frequently must be mechanically introduced to the enclosure. Consideration must be given to the most effective methods for introducing this fresh air supply. This consideration should include: point of introduction, velocity, heating, cooling, humidification, and filtering.

1970

34996 **APTIC NO. 58212**

Epperly, W. Robert

ROLE OF FUEL CONSUMPTION IN CONTROLLING AUTOMOTIVE EMISSIONS. *Air Pollution Control Assoc., Pittsburgh, Pa., Proc. Air Pollution Control Assoc., Mid-Atlantic States Sect., Semi-Annu. Tech. Conf. Transp. Impact Air Pollut., Harrisburg, Pa., 1970, p. 69-77, 83-90. (Oct. 8-9.)*

The role of fuel composition in the control of automotive emissions is discussed. The four principal composition factors which affect exhaust emissions are volatility, unsaturate (olefin) content in the light fractions of gasoline, the use of surfactant additives to keep engines clean, and the use of lead additives to increase octane ratings. The economic effects of these factors are described. The effect of changing gasoline front end composition on the Los Angeles atmosphere, reasons for reducing tetraethyl lead in gasoline, value of octane to the customer, typical compositions of gasolines of the same antiknock quality, the estimated photochemical reactivity of gasolines, and the effect of lead removal on valve train wear are mentioned.

34997 **APTIC NO. 58220**

Fagley, Walter S.

CONTROLLING EMISSIONS FROM MOTOR VEHICLES. *Air Pollution Control Assoc., Pittsburgh, Pa., Proc. Air Pollution Control Assoc., Mid-Atlantic States Sect., Semi-Annu. Tech. Conf. Transp. Impact Air Pollut., Harrisburg, Pa., 1970, p. 43-48, 83-90. 9 refs. (Oct. 8-9.).*

Engine exhausts, crankcase vents, carburetor vents, and fuel tank vents produce hydrocarbons, oxides of nitrogen, carbon monoxide, and particulates as the major pollutants. Particulates, CO, and NOx are emitted in the exhaust; HC come from the exhaust (60%) and from the crankcase and fuel evaporation (60%). Crankcase blowby emissions can be eliminated by a positive crankcase ventilation valve. Evaporation emissions from the carburetor and fuel tank can be removed by adsorption on charcoal or by reuse of the vapors accumulated in the crankcase as additional fuel. Exhaust emission controls include improved carburetion, improved spark timing, improved gasket fit, design changes, and other engine operation modifications. Control of NOx can be accomplished by engine operation modification (spark retarding, reduced compression ratio, improved fuel-air ratios), water injection, exhaust gas recirculation, catalytic muffler or thermal reactor systems, and the use of liquefied petroleum gas or compressed natural gas as fuels.

34998 **APTIC NO. 58237**

Ganey, John M.

FUELS - LIQUEFIED PETROLEUM GAS. *Air Pollution Control Assoc., Pittsburgh, Pa., Proc. Air Pollution Control Assoc., Mid-Atlantic States Sect., Semi-Annu. Tech. Conf. Transp. Impact Air Pollut., Harrisburg, Pa., 1970, p. 78-90. (Oct. 8-9.)*

The properties, production, and use of liquefied petroleum gas (LPG) are discussed. Propane is the LPG most commonly used. Propane HD-5 is the grade designated for motor fuel. The normal accumulation of carbon and sludge, inherent in gasoline and diesel fueled engines, is nonexistent with propane. The exhausted gases contain almost no carbon monoxide. The advantages of LPG are a clean engine, reduced oil cost, lower replacement or repair costs, increased spark plug life, less carburetion expense, less down time, less spillage and evaporation loss, and cleaner exhaust. Propane is also the safest fuel on the market because of its sealed fuel system and its lower air pollution.

34999 **APTIC NO. 58270**

Garrison, Theodore W., III

STUDENT AWARD PAPER. THE INTERNAL COMBUSTION ENGINE UNDER ATTACK. *Air Pollution Control Assoc., Pittsburgh, Pa., Proc. Air Pollution Control Assoc., Mid-Atlantic States Sect., Semi-Annu. Tech. Conf. Odors Detect., Meas. Control., New Brunswick, N. J., 1970, p. 74-88. 32 refs. (May 13.)*

Automotive emissions are discussed. The Federal automobile emission standards and control measures are reviewed. Automobile emissions can be reduced by banning cars from downtown areas, removing lead from gasoline, using natural gas as a fuel, installing control devices, and replacing spark ignition engines with low-polluting engines such as gas turbines, electric engines, and steam engines. Recommendations of the Senate s Commerce Committee are described for reducing pollution.

35000 **APTIC NO. 58211**

Miesse, C. C.

TRANSPORTATION MANAGEMENT FOR ENVIRONMENTAL QUALITY. THE AUTOMOTIVE ROLE IN AIR POLLUTION CONTROL. *Air Pollution Control Assoc., Pittsburgh, Pa., Proc. Air Pollution Control Assoc., Mid-Atlantic States Sect., Semi-Annu. Tech. Conf. Transp. Impact Air Pollut., Harrisburg, Pa., 1970, p. 91-105, 120-134. (Oct. 8-9.)*

Automobiles are a major source of carbon monoxide. This problem and its control by various devices and regulations are discussed. The following subjects are discursed in figures: air pollution emissions in the U. S. and their sources, daily CO emissions from motor vehicles in Los Angeles, the relationship between traffic volume and CO concentration in Frankfurt, Germany, the variation of CO emissions with driving gear and vehicle weight, the variation of CO emissions with driving speed, hydrocarbon emissions from controlled and uncontrolled vehicles, reduction in CO emissions at idle after a tune-up, variations of expressway vehicle speed with distance from a mild-city entrance, and the total CO emission from 5000 vehicles in 1/2 hour over an 8-mile length of expressway.

35001 **APTIC NO. 58226**

Norton, C. McKim

TRANSPORTATION, AIR POLLUTION AND THE SHAPE OF METROPOLITAN AREAS. *Air Pollution Control Assoc., Pittsburgh, Pa., Proc. Air Pollution Control Assoc., Mid-Atlantic States Sect., Semi-Annu. Tech. Conf. Transp. Impact Air Pollut., Harrisburg, Pa., 1970, p. 106-112, 120-134. (Oct. 8-9.)*

Research by the Regional Plan Association regarding waste management, air pollution, and transportation is discussed. The automobile is the most important source of air pollution among transportation sources. Transportation accounts for 42% of all pollution by weight. Even if automobile emissions are controlled, increased automobile use would result in an increase of emissions. Methods of reduce automobile emissions are mentioned, including the increased use of mass transportation. Land use requirements for mass transportation are outlined. Since most of the projected growth will occur in the suburbs, it will be hard to build mass transportation systems to these spreading areas. Planned urban development zoning, however, is beginning to produce communities with population densities high enough to support mass transportation.

35002 **APTIC NO. 58268**

Rickles, Robert N.

PRESENT STANDARDS OF ODOR CONTROL TECHNOLOGY. *Air Pollution Control Assoc., Pittsburgh, Pa., Proc. Air Pollution Control Assoc., Mid-Atlantic States Sect., Semi-Annu. Tech. Conf. Odors Detect., Meas. Control, New Brunswick, N. J., 1970, p. 41-45. (May 13.)*

Odor controls should be designed to reduce the odor levels at the stack to levels at or below the known or identified odorous threshold. This is because it is not possible to reliably utilize diffusion equations to calculate the potential impact of odorous emissions on neighboring communities. In addition, the presence of accidental emissions may make it possible to only use a drastic reduction to eliminate the odor s effect on the nearby communities. Diffusion is examined as a control method. Other control methods include incineration, catalytic oxidation, oxidation, activated carbon adsorption, masking, or scrubbing.

35003 **APTIC NO. 58269**

Walsh, W. H.

INDUSTRIAL EXPERIENCES IN SOLVING ODOR PROBLEMS. *Air Pollution Control Assoc., Pittsburgh, Pa., Proc. Air Pollution Control Assoc., Mid-Atlantic States Sect., Semi-Annu. Tech. Conf. Odors Detect., Meas. Control, New Brunswick, N. J., 1970, p. 36-40. (May 13.)*

Solutions to odor problems are discussed in general. Adsorption, scrubbing, and other methods may not be needed, if the odor is monitored and an engineer is called in to change the operating variables to reduce the odors. When the basic process causing the odor is understood, a simple solution may be implemented. Several examples are discussed. The proper use of thermodynamics may help solve the problem. The most effective control is to not allow the pollutant to be initially generated.

1969

35004 **APTIC NO. 57990**

Abboud, Harry I.

AEROSOL FILTERING APPARATUS. *(Assignee not given.) U. S. Pat. 3,429,106. 6p., Feb. 25, 1969. 13 refs. (Appl. May 22, 1967, 11 claims).*

A bag filtering unit is described for filtering gases laden with aerosols and very fine particulates which automatically cleans itself at intervals so that bag replacement is unnecessary. The unit consists of a settling drum with means for removing, the trapped dust at the bottom, into which the dirty gas enters. The bag filter is mounted in the top on an exit tube which is concentric with another. In the annular space between the two cylinders is a cylindrical flapper valve. The filtered air exits through the inner cylindrical tube, but during a cleaning cycle air at higher pressure enters the annular space, vibrates the flapper valve, and passes in reverse direction into the settling drum. The vibrations and the reverse flow serve to loosen the particles on the bag. This occurs in 0.15 sec to 0.5 min once every 1 min to 30 min automatically by a timer and automatic valves. The resilient flapper valve can be designed to cover the exit tube when the cleaning operation is occurring, or the design can be such that a restriction where the two come together causes a partial vacuum in the exit line.

35005 **APTIC NO. 57964**

Baum, Werner H., Joseph G. Crist, and Elliott V. Nagle

A PROCESS FOR REMOVING NITRIC OXIDE FROM GASEOUS MIXTURES. *(U. S. Steel Corp.) U. S. Pat. 3,428,414. 3p., Feb. 18, 1969. 2 refs. (Appl. June 2, 1966, 9 claims).*

A method of removing nitric oxide from gaseous mixtures by oxidizing NO to nitrogen dioxide is discussed. Any NO2 that is formed reacts with reactive organic material to form organic-nitrogen-oxygen compounds which precipitate from the gas and may be removed by wet or dry scrubbing. A small quantity of NO2-containing gas is admixed with the gas containing NO, oxygen and reactive organic material. By adding NO2 continuously to the flowing gas, the reactions that eliminate NO are catalyzed and sustained. The preferred temperature in the reaction chamber is between 60 and 100 C. The concentration of NO2 may vary between 40% and 80% of the concentration of NO. The NO2-containing gas may be NO2 itself or a gas such as nitrogen tetraoxide. The process requires a minimum concentration by volume of reactive organic material. The process operates successfully when an NO2-enriched gas resides for a short time in an elevated temperature reaction chamber.

35006 **APTIC NO. 58023**

Bentele, Max

SMOG CONTROL SYSTEM. *(Curtiss-Wright Corp.) U. S. Pat. 3,438,198. 9p., April 15, 1969. 4 refs. (Appl. May 22, 1967, 12 claims).*

A system for reducing the quantity of unburned hydrocarbons and other harmful substances discharged by internal combustion engines into the atmosphere is discussed. Air is injected into the exhaust gas stream, and strategically located mixing devices promote the oxidation of unburned materials in the exhaust. This is done by thoroughly mixing the air with the exhaust gases and increasing the time available for the oxidation of such materials in the system.

35007 **APTIC NO. 57967**

Berg, Bengt

METHOD IN OPERATING CONDITIONING TOWERS FOR FURNACE FUMES CONTAINING DUST TO BE RECOVERED BY MEANS OF ELECTROSTATIC PRECIPITATION. *(Aktiebolaget Svenska Flaktfabriken, Stockholm (Sweden)) U. S. Pat. 3,431,707. 3p., March 11, 1969. 4 refs. (Appl. April 5, 1967, 4 claims).*

A method for controlling the water spray in conditioning towers for dust-laden furnace fumes or flue as is discussed. When the quantity and temperature of the flowing fumes varies, it is desirable to minimize the wetting of the tower walls by the moistened dust. This can be done by giving the water droplets supplied to the fumes a shorter evaporation path at lower gas speed. At decreased loads, the spray is regulated to provide smaller droplets injected at higher speeds to provide a shorter evaporation path. The method uses a separate gaseous atomizing medium, such as compressed air, into which water is fed to produce a spray in the tower, and when the load is reduced, the atomizing medium is maintained constant while the water injection is reduced. The reduction in load is sensed by the wet bulb temperature outlet and/or inlet of the onditio ing tower.

35008 **APTIC NO. 58009**

Blackwell, Noah E., III and William J. Metrailer

DESULFURIZATION PROCESS. *(Esso Research and Engineering Co., Inc.) U. S. Pat. 3,446,728. 5p., May 27, 1969. 4 refs. (Appl. Oct. 4, 1966, 6 claims).*

A new method for producing a fuel oil containing less than 1.0 wt% sulfur from a petroleum residuum containing more than 2-3% sulfur makes vacuum distillation applicable to high gravity and high sulfur feeds, and requires a minimum pretreatment of the feeds. The process comprises the sequential steps of heat-soaking the feed in the presence of hydrogen and hydrogen sulfide, distilling to recover a treated vacuum gas oil fraction, hydrodesulfurizing the vacuum gas oil in the presence of a catalyst, recovering the desulfurized oil, and blending it with vacuum tower bottoms. Any suitable type of hydrodesulfurization reactor can be employed. Mixtures of the oxides and sulfides of cobalt, nickel, tungsten, and molybdenum on supports containing alumina, bauxite, silica, magnesium, or zirconia are preferred catalysts. The process achieves a sulfur reduction of 30-70 wt% based on the sulfur content of the petroleum residuum.

35009 **APTIC NO. 58196**

Bornefalk, Jan O.

TEXTILE FILTER FOR DUST FILTRATION PRODUCES A HIGH FILTRATION LEVEL AND GROWS IN IMPORTANCE. *(Textilfilter for stoftavskiljning: ger hog avskiljningsgrad och far okad betydelse). Text in Swedish. Tek. Tidskr., 99(24):357-359, 1969. 5 refs.*

Three types of filters are currently sold: electrostatic filters, venturi scrubbers (with high pressure drop), and textile filters, which give the highest degree of filtration. The three main types of textile filters are reviewed: frame filters, high-pressure return cylindrical filters, and tube filters with varying degrees of automation. Frame filters have a comparatively large filtration surface per cu m of volume. Although they are particularly useful in lower gas flows and low dust concentrations, the cleaning process is complicated and maintenance costs are high. High-pressure return cylindrical filters are used primarily in the mill industry operating at 400 cu m/sq m/hr. The filter tubes in these filters are threaded onto circular threaded pipes since the flow direction is inward. Heavy load and demand for good filtration slows the action of the filter tubes, which reduces the flow out of the high-pressure return tubes. High costs limit the effort that can be expended to develop more effective textile filters.

35010 **APTIC NO. 58201**

Butler, B. J., N. B. Akesson, and W. E. Yates

USE OF SPRAY ADJUVANTS TO REDUCE DRIFT. *Trans. ASAE (Am. Soc. Agr. Engrs.), 12(2):182-186, March-April 1969. 15 refs. (Presented at the American Society of Agricultural Engineers, Annual Meeting, Logan, Utah, June 1968, Paper 68-148.)*

Pesticide spray drift can be reduced by eliminating the fine droplets from the spray cloud produced during application. Increasing large drop number reduces pesticide effectiveness. Modifying the spray mixture is a means of eliminating fine drops and not increasing large drops. The adjuvants Dacagin, Norbak, Vistik, and Keltex increased spray viscosity. Test conditions were set up to test Dacagin, Vistik, and Norbak for their drift reducing potential. Simulated aircraft conditions were set up using a Spraying System D-8 disk type cone spray tip, operating with and without a No. 46 core. The three adjuvants were added to separate spray mixtures. Spectra of the spray drift droplets were recorded. All three adjuvants reduced the fine drop number. Norbak proved to have the best uniformity of drop size. The order of the results in reducing fine drop size and creating uniformity of drop size is Norbak, Vistik, Dacagin, and the unthickened spray. Ten figures showing drop spectra are given, and two tables comparing results are shown.

35011 **APTIC NO. 57986**

Re Rycke, Douglas August Charles and Owen Gordon Parker

CATALYTIC MUFFLER. *(Peter Spence and Sons Ltd., Lancashire (England) and Burgess Products Co. Ltd., Leicester (England)) U. S. Pat. 3,434,806. 6p., March 25, 1969. 7 refs. (Appl. March 8, 1965, 2 claims).*

A catalytic muffler was designed to reduce the amount of combustibles discharged to the atmosphere by internal combustion engines. Exhaust gases pass dowawards through a bed of catalyst in the container, which may be arranged in series with an automotile exhaust pipe and can also serve as a silencer. The catalyst chamber has an internal brace, which divides it into two compartments, and a filling device which allows the catalyst to be supplied to both chambers simultaneously.

35012 **APTIC NO. 57987**

Driscoll, Tommy and Homer Richards

APPARATUS FOR USE WITH AN INTERNAL COMBUSTION ENGINE FOR REDUCING AIR POLLUTION. *(Assignee not given.) U. S. Pat. 3,431,898. 4p., March 11, 1969. 11 refs. (Appl. Feb. 1, 1967, 4 claims).*

Trapping heavy hydrocarbons from an internal combustion engine crankcase is discussed. A duct connects the crankcase to the combustion air intake where noxious gases are withdrawn. The contaminants are trapped in a filter provided in the duct. The filter consists of a transparent filter housing which is a frustum-shaped cavity containing a filter cartridge of cylindrical form. The filter cartridge, which is disposable, is a perforate of cellular resilient material, such as sponge rubber or plastic. The filter housing is transparent to reveal the degree of contamination of the filter cartridge. This can then be removed and a new cartridge inserted. The effective period of the filter cartridge depends on the condition of the internal combustion engine and how it is operated.

35013 APTIC NO. 57988

Dram, Daniel D.

APPARATUS FOR COLLECTING CONTAMINANTS FROM GASES. *(National Dust Collector Corp., Skokie, Ill.) U. S. Pat. 3,432,153. 7p., March 11, 1969. 2 refs. (Appl. Sept. 25, 1967, 10 claims).*

A method for collecting contaminants from gases and for cooling and collecting the contaminants from high temperature gases before they are released into the atmosphere is discussed. The device used for this method comprises a quenching chamber with an inlet where the contaminated stack gases flow. The lower end of the chamber consists of a liquid collecting trough and a valve member including a depending skirt which is movable between a closed position where it extends into the liquid in the trough forming a gas-tight liquid seal between the stack and the chamber, and an open position where it is placed above the liquid, allowing the stack gases to flow into the chamber. When the valve member is open, liquid is directed onto the top of it and flows downward around the skirt into the trough forming a continuous,-flowing liquid curtain for cooling and collecting the contaminants in the gases. The liquid medium also serves to cool and wash the wall surfaces and components of the apparatus so that excessive deterioration does not occur. Means are provided for removing the contaminant and sludge material collected in the quenching liquid, and this is then recirculated through the system.

35014 APTIC NO. 57960

Elberson, John L.

APPARATUS FOR SCAVENGING EXHAUST GASES. *(Assignee not given.) U. S. Pat. 3,430,617. 5p., March 4, 1969. 4 refs. (Appl. April 18, 1967, 4 claims).*

A modification is described for internal combustion engines using spark ignition which provides an additional period of ignition during the exhaust cycle. Ordinarily, the spark plug fires at the start of the power stroke only, but the addition of an extra arm on the distributer set at an angle so that the same cylinder will fire again during the exhaust stroke causes the complete combustion of the hydrocarbons that would normally enter the exhaust system to be discharged to the atmosphere. This double ignition could be done with two spark plugs, distributers, and coils, but it is the intention of the invention to do it by modifying only the distributer.

35015 APTIC NO. 57960

Grantham, Le Roy F.

TWO-STAGE REGENERATION OF ABSORBENT FOR SULFUR OXIDES. *(North American Rockwell Corp.) U. S. Pat. 3,438,728. 7p., April 15, 1969. 4 refs. (Appl. May 15, 1967, 8 claims).*

A method of removing sulfur oxides from flue gas is discussed. The process consists of the separate steps of absorption, reduction, and reformation. In the absorption stage, sulfur oxides present in a hot combustion gas are removed by contacting the gas with a molten salt mixture containing alkali metal carbonates as an active absorbent. For the two-stage regeneration, in the first step of reduction the molten absorbent solution, containing alkali metal sulfite, is treated with a reductant gas mixture containing hydrogen and carbon monoxide to convert the absorbed sulfur values to alkali metal sulfide in the molten salt. In the second step of the reformation the molten salt is treated with a gaseous mixture containing steam and carbon dioxide to regenerate the alkali metal carbonate and convert the alkali metal sulfide to hydrogen sulfide gas. This hydrogen sulfide gas is a suitable feedstock for ready conversion to sulfur or sulfuric acid.

35016 APTIC NO. 57907

Grantham, Le Roy F. and Christian M. Larsen

SULFUR PRODUCTION USING CARBON REGENERANT. *(North American Rockwell Corp.) U. S. Pat. 3,438,733. 6p., April 15, 1969. 2 refs. (Appl. May 15, 1967, 4 claims).*

A method of removing sulfur dioxide from flue gas and recovering it as sulfur is discussed. The process consists of an absorption step and a regeneration step. In the absorption step the SO2 gas is contacted with a molten salt mixture containing alkali metal carbonates to form alkali metal sulfites. In the regeneration stage, the molten salt containing alkali metal sulfite carbon, forming elemental sulfur and regenerating the alkali metal carbonate absorbent. This process is able to eliminate 99.9% of the SO2 in the flue gas.

35017 APTIC NO. 57958

Grantham, Le Roy F.

SULFUR PRODUCTION USING CARBON OXIDE REGENERANT. *(North American Rockwell Corp.) U. S. Pat. 3,438,734. 8p., April 15, 1969. 6 refs. (Appl. May 15, 1967, 7 claims).*

A method for removing sulfur dioxide from flue gas and recovering it as elemental sulfur is discussed. The process consists of absorption, reduction, and reformation stage. In the absorption stage, sulfur oxides present in hot combustion gas are removed by contacting the gas with a molten salt mixture containing alkali metal carbonates as the active absorbent. In the reduction step the molten absorbent solution, containing alkali metal sulfite, is treated with a reductant gas mixture, containing hydrogen and carbon monoxide, to convert the absorbed materials to alkali metal sulfide in the molten salt. The reformation step consists of treating the alkali metal sulfide with alkali metal sulfite and a gaseous mixture containing carbon monoxide, carbon dioxide, or both, to regenerate the alkali metal carbonate absorbent and form elemental sulfur. This process can eliminate 99.9% of the SO2 in the flue gas.

35018 APTIC NO. 57991

Graves, John H.

FILTER BAG WITH ATTACHED ENCIRCLING RING. *(Phillips Petroleum Co.) U. S. Pat. 3,429,107. 3p., Feb. 25, 1969. 6 refs. (Appl. July 18, 1966, 3 claims).*

An improvement to a type of bag filter using reinforcing rings is described which increases the life of these bags. The filter bags take the form of elongated cylinders and are made of fibrous material such as fiberglass in the case of the carbon black industry. The reinforcement rings are of the same diameter as the bags and can be placed at intervals along the length of the bag to aide in both filtering plant air and in removing the trapped contents of the bags. The improvement is in the method of attaching the rings. It requires a sleeve of the same material as the bag be sewn around the ring and then sewn to the wall of the bag.

35019 APTIC NO. 58049

Hall, R. B. and R. W. Stanton

THE DISPOSAL OF LIQUID AND GASEOUS EFFLUENTS FROM A WOOD FIBRE WALLBOARD PLANT SITUATED IN METROPOLITAN AUCKLAND, NEW ZEALAND. *Appita, 22(5):133-139, March 1969. 11 refs.*

The measures taken to dispose of liquid and gaseous effluents found in the hardboard smoke emitted from a plant manufacturing wood fiber insulating board and hardboard are described. Though its exact composition is not known, the smoke contains acrolein, formaldehyde, acetic acid, carbon dioxide, carbon monoxide, aldehydes, and phenolic materials. When neither a catalytic combustion unit nor a venturi-type scrubber affected smoke disposal and deposition of tars collected in the stack, it was decided that effluents might be diluted by discharging smoke at a considerable height. A 200-foot stainlesssteel stack, with an aluminum inner tube, was constructed which discharges 60,000 cu ft/m at 180 F. Its efficiency is difficult to judge; under certain wind conditions, the charred wood odor is still a problem, and deposition of tars has been negligible.

35020 **APTIC NO. [illegible]**

Heredy, Laszlo A.

ABSORBENT REGENERATION USING CARBON REGENERANT. *(North American Rockwell Corp.) U. S. Pat. 3,438,727. 9p., April 15, 1969. 3 refs. (Appl. May 15, 1967, 9 claims).*

A method of removing sulfur dioxide from flue gas is described. The process consists of the absorption of SO2 in a molten salt mixture containing alkali metal carbonate to form alkali metal sulfite, and regeneration of the absorbent and recovery of hydrogen sulfide by either a one-stage of two-stage treatment of the absorbent solution. For single-stage regeneration, the sulfite-containing absorbent is reacted with a hydrocarbonaceous material, preferably composed of carbon and hydrogen. For the two-stage regeneration the absorbent solution is first treated with a carbonaceous material to reduce the alkali metal sulfite to alkali metal sulfide, which is then treated with a gaseous mixture containing steam and carbon dioxide to form H2S and regenerate the alkali metal carbonate absorbent. The recovered H2S is a suitable feedstock for a sulfuric acid plant or for production of elemental sulfur.

35021 **APTIC NO. 87997**

Heredy, Laszlo A., Donald E. McKenzie, and Samuel J. Yosim

REMOVAL OF SULFUR OXIDES FROM FLUE GAS. *(North American Rockwell Corp.) U. S. Pat. 3,438,722. 7p., April 15, 1969. 2 refs. (Appl. May 15, 1967, 7 claims).*

A method of removing sulfur dioxide from flue gas is described. Sulfur oxides present in hot combustion gas are removed by contacting the gas with a molten salt mixture containing alkali metal carbonates as an active absorbent. The absorbent is regenerated by treatment of the molten absorbent solution with a gaseous mixture containing hydrogen and either carbon monoxide or carbon dioxide. The alkali metal carbonates are regenerated and hydrogen sulfide is formed. The H2S can be used as a feedstock for a sulfuric acid plant or for production of elemental sulfur.

35022 **APTIC NO. [illegible]**

Hilge, Helmut

DEVICE FOR CLEANING THE ELECTRODES IN AN ELECTROSTATIC DUST SEPARATOR. *(Klockner-Humboldt-Deutz Aktiengesellschaft, Cologne (West Germany)) U. S. Pat. 3,427,787. 5p., Feb. 18, 1969. 13 refs. (Appl. March 8, 1966, 7 claims).*

A device for cleaning the ionizing electrodes of an electrostatic dust precipitator is claimed which has the advantages of a hammer-type unit without the disadvantages of projecting an electrically insulated rotating shaft through the side of the air duct. A horizontal shaft containing swinging hammers is mounted perpendicular to the rods from which the ionizing electrodes hang so that each hammer will hit the end of one rod, but one at a time, as the shaft rotates. This rotation is effected by a crank-rod and two ratchets which only allow one direction of motion as the crank-rod is reciprocated up and down. The crank-rod is insulated and is moved by a reduced speed motor mounted on top of the duct. As the motor moves the crank up and down, the shaft is rotated and the hammers strike the rods one at a time causing the hanging electrodes to vibrate and release the dust. This is better than an action which would vibrate all electrodes at once causing large amounts of dust to be loosened.

35023 **APTIC NO. [illegible]**

Hunter, William K.

POLLUTION CONTROL: TAKE INVENTORY. *Chem. 26, 5(5):56-57, June 1969. (Presented at the National Pollution Control Conference, Houston, Tex., April 23-25, 1969.)*

There are five basic types of air pollution control equipment, each differing from the other in terms of capability and initial operating costs. They are mechanical centrifugal collectors, electrical precipitators, fabric filters, wet scrubbers, and odor incineration systems. Within each basic equipment type, costs vary significantly with respect to the performance that is required. To increase the quality of air in the next decade, expenditures for pollution control equipment will need to more than double. When considering an air pollution control system four procedures are necessary: an inventory of all air pollution emission sources from the plant; an inventory of all incoming air usage and all other air usage within the plant; an analysis of the air usage requirements to minimize air contamination and processing costs; and an analysis of the available types of control equipment. Advance thinking in the fourth category can be very significant since the addition of certain equipment may improve product quality by reducing product contamination.

35024 **APTIC NO. 87963**

Hurko, Bohdan and Raymond L. Dills

SELF-SUSTAINING CATALYTIC OXIDATION UNIT. *(General Electric Co.) U. S. Pat. 3,428,435. 5p., Feb. 18, 1969. 3 refs. (Appl. Sept. 15, 1964, 5 claims).*

A catalytic oxidation unit for treating hot gaseous products from self-cleaning ovens is discussed. It comprises a hollow housing having an inlet and an exhaust opening. A perforated ceramic block is transversely arranged within the housing for receiving hot gases which heat it. A catalytic material, such as platinum, covers the cellular surfaces exposed to the gases to reduce the temperatures at which oxidation of smoke and odors occurs. The surface area of the cells is large to provide a longer period of contact between the gases and the catalyst. At a minimum temperature of 300 F to 400 F, smoke, odors, and other undesirable gases products present in the hot gases undergo and exothermic reaction and increase the rate of temperature rise of the ceramic block above the rate of temperature rise of the chamber where the gases were generated until they have been incinerated. Smoke, odors, and other undesirable properties present in the gases are eliminated before the gases are discharged into the atmosphere.

35025 **APTIC NO. [illegible]**

Hurko, Bohdan

TWO-STAGE SELF-SUSTAINING CATALYTIC OXIDATION UNIT. *(General Electric Co.) U. S. Pat. 3,428,434. 4p., Feb. 18, 1969. 3 refs. (Appl. Sept. 15, 1964, 6 claims).*

A catalytic oxidation unit for treating hot gases from a self-cleaning oven is discussed. It consists of a first and second housing where the second housing is supported from the first in tandem relation. Each contains a platinum coating perforated ceramic block for receiving hot gases so that at a minimum temperature of 300 F to 400 F the smoke and other undesirable properties in the gases undergo an exothermic reaction and render the temperature of the ceramic block self-sustaining. A limited amount of primary air is supplied to the first housing and a limited amount of secondary air is supplied to the second housing downstream of the first housing so that only partial combustion takes place in the first housing during very heavy soil loading conditions while complete combustion takes place in the second housing. This prevents the possibility of ignition when handling very heavy loads of volatile products. For normal loads, complete combustion may take place in the first stage.

35026 **APTIC NO. 58269**

Hlinicz, J. and L. Porowski

UTILIZATION OF STEEL FURNACE DUSTS BY THE METHOD OF CHEMISORPTION. *(Utylizacja pylow stalowniczych sposobem chemisorpcji). Air Conserv. (English translation from Polish of: Ochrona Powietrza), 3(5):13-17, 1969. (Presented at the Association of Metallurgical Engineers and Technicians, Conference on Modern Trends in Cleaning of Industrial Gases by Wet Methods, Bielsko, Poland, March 1969.)*

NTIS: TT 70-55123/5

The use of steel furnace dusts with low iron oxide content captured by chemisorption in acid solution is discussed. The dusts from an arc furnace was dissolved in spent etching solutions, and dust sorption was measured. This method of adsorption of dust in acid solutions is seldom economically feasible. This method can be applied under favorable local conditions in a plant possessing an etching department and eventually a source of cheap ammonia for processing of iron oxide poor dusts which cannot otherwise be utilized cheaply.

35027 **APTIC NO. 57983**

Innes, William B.

OXIDATION CATALYST FOR HYDROCARBON COMBUSTION EXHAUST GASES AND PROCESS FOR USING THE SAME. *(American Cyanamid Co., Stamford, Conn.) U. S. Pat. 3,438,721. 18p., April 15, 1969. 3 refs. (Appl. Dec. 10, 1964, 7 claims).*

A method of oxidizing hydrocarbon combustion exhaust gases is discussed. The main object is to provide a catalyst material for the oxidation of automobile combustion exhaust gases which is highly effective in oxidizing the smog forming components of exhaust gases. The catalyst consists of alumina, vanadium oxide, and copper oxide. The addition of some noble metal is desirable. Oxidation takes place when the exhaust gases are contacted in the presence of oxygen with the catalyst. When used in an automotive gas converter, this catalyst overcomes the overheating problem of such converters, is characterized by a low ignition temperature, and obtains a high percentage conversion of both carbon monoxide and hydrocarbons. It also has a high stability to lead poisoning. Oxygen flowing through the gas converter should move at a rate sufficiently high to oxidize the exhaust gases, but at a rate low enough to prevent overheating of the converter. The flow rate should also be low enough to prevent cooling of the catalyst below its ignition temperature.

35028 **APTIC NO. 58853**

Janson, William A.

GAS FILTER STRUCTURE. *(North American Rockwell Corp.) U. S. Pat. 3,422,602. 5p., Jan. 21, 1969. 20 refs. (Appl. Feb. 27, 1967, 4 claims).*

The invention comprises a filter structure where a bank of flexible tubular filter bags have their open ends permanently attached to a front panel which is a molded grating-like structure having the filter ends embedded in the panel material at the air admission openings. This provides a secure anchor and airtight mounting for the filter elements, preventing unfiltered air from bypassing them. The main object is to provide a filter assembly of the extended area type in which the open ends of elongated flexible tubular filter elements are permanently united with a correspondingly apertured front panel.

35029 **APTIC NO. 58898**

Jones, Allen H.

HOW TO IMPROVE MAINTENANCE OF FABRIC DUST COLLECTORS. *Minerals Process., 10(5):21-23, 35, May 1969. 2 refs. (Presented at the Fourth Minerals Processing Maintenance Symposium in Chicago, June 1968.)*

The key to low maintenance of a cloth dust collection system is early detection of problems. Since dust collectors are self destructive once they begin to malfunction, weekly visual inspection with proper measurements is necessary. The manometer, which measures pressure, is a basic instrument to measure a dust control system. A manometer combined with a pilot tube is used to measure velocity pressure, the pressure exerted by moving air. Another simple measurement that can help evaluate a dust collection system is a tachometer to measure fan speed. Any reduction or increase in fan speed will change the system volume in direct proportion. The ammeter, another measuring device, reads the amp drawn by the fan motor, which is directly proportional to the air volume. Temperature at the inlet of the dust collector should also should be measured to assure that it doesn t exceed the manufacturer s rating for the equipment since the volume increases with temperature. These readings should be taken weekly at the same time visual inspection is made.

35030 **APTIC NO. 57989**

Kawanami, Shunpei

DUST COLLECTOR. *(Kabushiki Kaisha Sanko Seisakusho (Japan)) U. S. Pat. 3,431,709. 4p., March 11, 1969. 11 refs. (Appl. Sept. 25, 1967, 3 claims).*

A dust-blowing device of the bag filter type intended for blowing off dust accumulated on a filter medium is discussed. It consists of a piston and a cylinder for producing an air blast on the filtering medium. This is located on top of the filtering medium and in the passage of filtered air. A second set of a piston and cylinder is located on top of the first set with its piston connected to that of the first set. This serves to actuate the latter by action of compressed air supplied through a magnetically controlled valve connected to the second set. A seal of flexible material with a number of fins allowing for irregularities is between the piston and cylinder of the first set.

35031 **APTIC NO. 57966**

Klouda, John F.

AIR-CLEANING APPARATUS. *(The Trane Co., La Crosse, Wis.) U. S. Pat. 3,438,180, 8p., April 15, 1969. 20 refs. (Appl. Dec. 28, 1965, 2 claims).*

An electrostatic air filtering device is discussed. It consists of a frame with openings for air flow and a filter cell mounted in the frame. The filter cell consists of a number of spaced ionizing wires with ground strips placed between them. The frame also has a lint screen and a charcoal pack mounted within it which can be interchanged when there is a change in the direction of air flow. The electrical conductor for the filter cell is in the center of one end so that it engages the contact on the power source in either of its positions.

35032 **APTIC NO. 57981**

Kolb, Kenneth E.

FILTER SYSTEM AND METHOD. *(Assignee not given.) U. S. Pat. 3,422,601. 5p., Jan. 21, 1969. 12 refs. (Appl. July 14, 1966, 1 claim).*

A method of filtering air contaminated by radioactive dust is discussed. The filter system has a number of filters enclosed by housings with common inlet and outlet ducts. A negative pressure is maintained in the ducts. A complete housing can be removed when the filter element requires replacement without shutting down the system. This is because both the inlet and outlet ducts are under a negative pressure, so the entire inside volume of the filter is also under a negative pressure. Thus any opening in the system will produce an air flow from the surroundings into the system, and particulate matter within the system cannot escape outward to the surrounding atmosphere. Air contaminated with radioactive dust particles is drawn from a room or building having a contaminated atmosphere, and is passed through a damper box, the inlet duct, into the filter, and through the outlet duct. The cleaned air may not be vented into the atmosphere via a stack.

35033 **APTIC NO. 57992**

Kossowski, Kazimierz and Harley G. Peterson

ELECTRICAL PRECIPITATOR. *(Joy Manufacturing Co. Pittsburgh, Pa.) U. S. Pat. 3,425,987. 5p., Feb. 11, 1969. 20 refs. (Appl. Dec. 23, 1964, 4 claims).*

A louver damper for an electrostatic precipitator is discussed. In gas cleaning operations, fluid flow control devices are applied to the dusty gas entering a precipitator or to the clean gas leaving a precipitator. Under certain conditions a louver damper is the most favorable type of adjustable fluid control device. It incorporates interchangeable links and levers to open and close the louvers in counter rotating sets. The advantages inherent in a louver damper of this type are a means in providing for adjusting blades to compensate for manufacturing errors; the number of moving parts is minimal, thus, reducing wear; a simple repetitive design of levers, links and slats results in minimum fabrication cost; and, by mounting the operating handle directly on a louver shaft, the additional bearings and shaft needed when a handle is mounted separately are eliminated.

35034 **APTIC NO. 57998**

Larson, Robert E.

AUTOMATIC-UNLOADING DUST VALVE FOR CENTRIFUGAL AIR CLEANERS. *(Donaldson Company, Inc., Minneapolis, Minn.) U. S. Pat 3,429,108. 4p., Feb. 25, 1969. 22 refs. (Appl. March 3, 1967, 2 claims).*

A device is described for the filtration of combustion air for internal combustion engines. It is a modification of the centrifugal type air filter which causes it to periodically unload itself. Where the normal filter has a port for cleaning out the accumulated dust, this device has a rubber valve sensitive enough to be open when the engine is not operating but to close by the action of the vacuum normally associated with internal combustion engines. Also this valve will partially open and close due to the pulsations of the pistons in the engine, in effect continuously cleaning itself.

35035 **APTIC NO. 58863**

Leibach, Heinrich and Ralph Vedova

FUEL SUPPLY FOR AFTERBURNER. *(M.A.N. Turbo GmbH, Munich (West Germany)) U. S. Pat. 3,434,289. 6p., March 25, 1969. 6 refs. (Appl. Jan. 27, 1967, 2 claims).*

A combustion device for use in the jet exhaust pipe of turbojet engines is described. With this device, a uniform temperature pattern is ensured by producing a nonuniform fuel injection pattern. A particular advantage is gained if the combustion device is applied to an elbow-type jet exhaust pipe receiving the engine exhaust gases or to a thrust diverting device which is positioned to divert the reheated engine exhaust gases from a horizontal into a vertical direction. To achieve a uniform temperature pattern and a corresponding favorable position of the hot combustion core in the thrust diverting device, a control system is provided which operates as a function of the diverting angle of the thrust diverter. This control system enables the fuel supply to the individual injector manifold segments to be reduced in proportion to the increasing diverting angle of the thrust diverter. Nozzle tubes are segmented for injecting fuel in a nonuniform pattern.

35036 **APTIC NO. 57996**

Lindstrom, Eddie G.

ANTISMOKE BARIUM PHENATE COMPOSITIONS. *(Chevron Research Co.) U. S. Pat. 3,438,756. 3p., April 15, 1969. 4 refs. (Appl. June 27, 1966, 6 claims).*

A barium compound for reducing the amount of smoke produced by diesel engines is described. The antismoke composition added to diesel fuels consists of a methylenic bridged alkylphenol, alkenylsuccinic acid, water and a hydrocarbon medium. At least 1.25 moles of barium as an oxide or hydroxide per mole of phenolic hydroxide is added. At a temperature of about 125 C, carbon dioxide is introduced. By employing this additive, a great amount of diesel smoke, and, therefore, dirt and grime, can be eliminated from the atmosphere.

35037 **APTIC NO. 58889**

McCubbin, Thomas L.

DUST CONTROL TECHNIQUES FOR A PORTLAND CEMENT PLANT. *Minerals Process., 10(5):24-25, 35, May 1969.*

The largest source of dust emission within cement plants is the kiln operation, which has three major components: feed system, fuel-firing system, and klinker-cooling and handling. The fuel-firing system, the kiln itself, has three major functions, drying, calcining, and klinkering. A suspension preheated with cyclones, or movable grate pre-heaters, partially control dust generated in the kiln. Additional control equipment such as cyclones, electrostatic precipitators or fabric filters are normally used for satisfactory collection of large amounts of kiln dust. Disposal of dust can present problems, unless it can be used as fertilizer or mineral filter. Some air pollution controls require dust collector efficiencies of 98.3 to 98.8%. These efficiencies are obtained through use of either fabric collectors or electrostatic precipitators in the final filter. The wide ranges of physical characteristics of the gases and dusts from cement kilns makes it difficult to properly size the required dust control equipment. Glass fabric dust collectors have the following advantages: simplicity of design and operation; inlet manifold to the tube sections is of simple design; if a tube fails in an upward flow dust collector, it can be tied off and the compartment can be put back on stream; a tube section can be shut-down for repairs without loss of dust collector provided better than 99% dust collector efficiency on a weight basis.

35038 **APTIC NO. 57982**

McKinney, Joel D. and William C. Offutt

START-UP OF A HYDRODESULFURIZATION REACTION. *(Gulf Research and Development Co., Pittsburgh, Pa.) U. S. Pat. 3,423,307. 4p., Jan. 21, 1969. 2 refs. (Appl. Nov. 12, 1965, 9 claims).*

A start-up procedure for use in a high-severity hydrodesulfurization process for the desulfurization of residual stocks containing both sulfur and asphaltic materials is discussed. The process is conducted under conditions of high severity so that at least 70% of the sulfur contained in the residual hydrocarbon feed stock is removed and so that there is a hydrogen consumption from 1 to 5 molecular weights of hydrogen per atomic weight of sulfur removed. The temperature employed should be about 850 F. The start-up procedure comprises initially contacting an asphaltic-free hydrocarbon with hydrogen in the presence of the catalyst at a temperature of about 250 to 500 F. The catalyst is a metalliferous hydrogenating component supported on an alumina carrier. This contacting is discontinued and contacting of the asphaltic-containing residual hydrocarbon and preheated catalyst is begun. Using this method, an improved catalyst life is obtained and the hydrodesulfurization process can begin at a temperature significantly lower than would otherwise be required.

35039 **APTIC NO. 58829**

Renault, Phillippe

PROCESS FOR CONVERTING HYDROGEN SULFIDE INTO ELEMENTAL SULFUR. *(Institut Francais du Petrole, des Carburants et Lubrifiants, Rueil-Malmaison (France)) U. S. Pat. 3,441,379. 4p., April 29, 1969. 7 refs. (Appl. March 30, 1966, 7 claims).*

The conversion of hydrogen sulfide into elemental sulfur is discussed. By utilizing a liquid ester of a phosphoric acid (a phosphate) as the reaction medium for producing elemental sulfur by the reaction of hydrogen sulfide with sulfur dioxide, the yield and rate of reaction are increased. The sulfur produced is in the form of readily filterable particles. Atmospheric pollution due to waste gases from the Claus process or others containing low concentrations of SO_2 and/or H_2S, can be substantially reduced.

35040 APTIC NO. 58830

Romeo, P. L.

NITRIC ACID TAIL GAS PURIFICATION. *(Engelhard Industries, Inc., Newark, N. J.) U. S. Pat. 3,425,803. 3p., Feb. 4, 1969. 2 refs. (Appl. Sept. 1, 1967, 6 claims).*

The purification of tail gases from nitric acid plants which contain oxides of nitrogen is discussed. The purification takes place in a catalytic gas burner usually containing palladium as the catalyst. The gases are purified by admixture with natural gas which has first been converted to hydrogen and carbon monoxide. The natural gas is admixed with steam and passed into a reformer which derives its great energy from a converter synthesizing oxides of nitrogen from ammonia. The process decolorizes and renders innocuous the gases passing into the atmosphere, by catalytically reducing the NO_x.

35041 APTIC NO. 58083

Rosendahl, Fritz

REMOVAL OF HYDROGEN SULFIDE FROM GASES--A DOCUMENTATION FOR 1965. *(Entfernung von Schwefelwasserstoff aus Gasen - eine Dokumentation fuer 1965). Text in German. Gas Wasserfach (Munich), 110(5):124-128, Jan. 1969. 85 refs.*

A review is made of experimental studies and patent claims published in 1965 on methods of hydrogen sulfide removal from natural gas, city gas, coal gas, water gas, industrial waste gases, and combustion gases of hydrocarbon fuels. Removal methods include absorption by metal oxides, activated charcoal (pure or impregnated with alkali salts), adsorption by activated soot, calcium oxide, silver, bauxite, and zeolites, and scrubbing by aqueous solutions of various inorganic and organic compounds. Methods of recovery of sulfur and S compounds from various purifying agents are also included.

35042 APTIC NO. 57993

Rozie, Maurice and Pierre Desire

PROCESS FOR RECOVERY AND USE OF SULFUR DIOXIDE. *(Sodiete Progil, Paris (France)) U. S. Pat. 3,431,072. 5p., March 4, 1969. 4 refs. (Appl. March 27, 1967, 8 claims).*

A process for the recovery and use of sulfur dioxide is discussed. Sulfur dioxide, contained in the effluents from the manufacture of sulfuric acid, employing the contact process, is reacted with the residual liquors obtained in the manufacture of alkali metal phosphates by the neutralization of phosphoric acid with alkali metal hydroxides and carbonates. The resulting mixture containing alkali metal sulfites and/or bisulfites is converted with oxygen or H_2SO_4. The resulting neutral sulfate-containing mixture is used as a reactant in the wet process for producing phosphoric acid.

35043 APTIC NO. 58061

Stephens, Ruth E., Daniel A. Hirschler, and Frances W. Lamb

OXIDATION CATALYSTS. *(Ethyl Corp., New York) U. S. Pat. 3,433,581. 10p., March 18, 1969. 3 refs. (Appl. Oct. 21, 1965, 8 claims).*

A method of oxidizing unburned hydrocarbons and carbon monoxide found in the exhaust gas of internal combustion engines is discussed. The catalyst consists of transitional alumina having an initial lamina of oxides of the First Transitional Series or the Lanthanide Series, followed by an outermost lamina of copper oxide. The finished catalyst must have at least two successive layers of metal oxides, and the outermost layer must be copper oxide. The alumina used, activated alumina, is an active desiccant, has active adsorbing characteristics, and can catalyze certain hydrogenation and dehydrogenation reactions. The exhaust gas products resulting from combustion of the gasoline fuel, together with an excess of air or oxygen, are contacted by the catalyst. All of the carbon monoxide is converted to carbon dioxide, and a large percentage of the unburned hydrocarbons are oxidized to carbon dioxide and water. The catalysts are resistant to the poisoning effects of the combustion products of sulfur and organolead antiknock agents, and are very durable.

35044 APTIC NO. 57999

Takeuchi, Tsugio

METHOD OF REMOVING SULFUR DIOXIDE AND SULFUR TRIOXIDE FROM GASES AND PRODUCING AMMONIUM SULFATE THEREFROM. *(Assignee not given.) U. S. Pat. 3,440,007. 2p., April 22, 1969. 2 refs. (Appl. March 15, 1965, 3 claims).*

A process is claimed for the selective removal of sulfur dioxide and trioxide from a combustion gas in such a way that it can be reclaimed as ammonium sulfate. The gas is passed through a bed of activated carbon placed in the flue so that the temperature is between 100 and 200 C. The SO_2 and the SO_3 are adsorbed on the carbon and then converted to sulfuric acid by the action of steam and oxygen also contained in the flue gas. When saturated, the carbon is placed in aqueous ammonia forming ammonium sulfate and regenerating the carbon. The carbon is then dried for reuse, and the ammonium sulfate recovered. Tests have shown a reduction from 1000 ppm sulfur oxides to 40 ppm sulfur dioxides with this procedure.

35045 APTIC NO. 58062

Taylor, William F. and John H. Sinfelt

EXHAUST GAS PURIFICATION. *(Esso Research and Engineering Co.) U. S. Pat. 3,429,656. 6p., Feb. 25, 1969. 3 refs. (Appl. Dec. 10, 1965, 6 claims).*

A method is described for the removal of polluting substances from the exhaust of internal combustion engines. It is easily adapted to new and old vehicles, is cheap, and is easily replaced when the chemicals within are exhausted. It involves a two-step process, the first removing by oxidation and adsorption sulfur dioxide and oxygen by a bed of catalysts of either copper, manganese, or vanadium oxide with aluminum and sodium oxide on an adsorbent such as kieselguhr; and the second removing carbon monoxide and nitrogen oxides with a reforming catalyst utilizing the steam in the exhaust. The second catalyst is a typical industrial catalyst containing a metal from the group of nickel or iron and also serves to break down the hydrocarbons in the exhaust. The two beds can be mounted in successive tubular containers so the emissions will pass through one and then the other.

35046 APTIC NO. 57857

Wilhelmsson, Gunnar

CYCLONIC SEPARATOR. *(Aktiebolaget Svenska Flaktfabriken, Stockholm (Sweden)) U. S. Pat. 3,426,509. 4p., Feb. 11, 1969. 9 refs. (Appl. May 31, 1966, 1 claim).*

A cyclonic separator consisting of a cylindrical casing with an inlet portion with a pair of tangential inlets for introducing dust-laden gas, and a central outlet for exhausting clean gas from the casing, is discussed. An imperforate end wall at the opposite end has cut-outs in its periphery providing diametrically-opposed dust outlets along the shell of the casing. The separator is mounted horizontally with the outlets in vertical alignment to open into a vertical dust channel connected to form a coherent discharge pipe to all of the vertically-aligned separators.

35047 APTIC NO. 58286

Zurakowski, S. and G. Konieczny

EFFECT OF SOME PHYSICO-CHEMICAL FACTORS ON DUST EXTRACTION FROM GASES BY THE FOAM

METHOD. *(Wplyw niektorych parametrow fizykochemicznych na odpylanie gazow w ukladach pianowych). Air Conserv. (English translation from Polish of: Ochrona Powietrza), 3(5):25-34, 1969. 4 refs. (Presented at the Association of Metallurgical Engineers and Technicians, Conference on Modern Trends in Cleaning Industrial Gases by Wet Methods, Bielsko, Poland, March 1969.)*

NTIS: TT 70-55123/5

The effects of various factors on the extraction of dusts from gases by the foam method and on formation of foam were analyzed mathematically. The effectiveness of a dust extractor was related directly to the means of filtration and the dust extraction filters. Formulas for efficiency of bag filters, electrofilters, and foam systems are given. The equation of interval effectiveness of aerosol particles in a foam system was analyzed. Foam formation conditions were studied. The absorption was related to the excess of dissolving substance on the surface of the solution, the surface tension of the solution, and the concentration of surface-active agents in the solution. The foam method was also studied in a laboratory using steelwork dusts and water. The water was acidified or alkalized to determine the relationship between pH of the fluid and hydrodynamic conditions of foam generation. As pH increased, the height of the initial layer of fluid increased, and thus the wetting increased to a certain point.

1968

35048 **APTIC NO. 57803**

Anderson, Thomas H.

SOME NEW APPROACHES TO AIR POLLUTION CONTROL. *Feedstuffs, 40(24):28-29, June 15, 1968. (Presented at the Missouri Grain and Feed Association, Jefferson City, Mo.)*

Sources of dust in the grain processing industry are chiefly dryers inefficient cyclone dust collectors, and transportation of grain. Costs of control can be recovered through improved operation, that is, reduction of grain loss. An experimental dryer is described which operates with high humidity, so the corn clings together and does not leave with the air. Total operating costs for power and fuel are about 60% less than in conventional dryers. A modern riverfront terminal was built with hooded belt conveyors. In addition, this plant had an enclosed, very high capacity belt conveyor which was an almost perfect dust control system at a cost lower than that of a comparable conventional plant without any dust control. The operation of the conveyor and controls at the cleaning operation are discussed.

35049 **APTIC NO. 57817**

Beals, G. C., and J. J. Cadle

COPPER AND BY-PRODUCT SULFURIC ACID PRODUCTION BY PARABOLA MINING COMPANY. *J. Metals, 20(7):85-92, July 1968.*

Parabola Mining Company is currently producing 80,000 tons per year of anode copper and 100,000 tons per year of 100% sulfuric acid. The refinery incorporates the latest developments in cathode melting furnaces and facilities for continuous rod production. Parabola also produces 3,000,000 tons per year of unfinished magnetite concentrate from the copper flotation tailings. Open pit mining operations currently remove over 12,000,000 tons per year of 0.68 to 0.74% copper ore. The smelter is of conventional design, consisting of a single, all basic refractory, wet side charge, coal-fired reverberatory furnace, three converters, two rotary anode furnaces, a power plant with two 30,000 converter air blowers, and a 10,000 generator. The converter isle consists of three converters, each equipped with stack fluxing, two radiation pyrometers, a rolling hood door, a guillotine damper, and a water-cooled hood. A converter charge consists of eleven 200 cu ft ladles of 40 to 44% copper matte charged in a 4-2-1-1-1-1-1, sequence. Smelter production is entirely dependent on the availability of concentrate. The converter isle is generally waiting for matte. The acid plant can accept 60,000 of converter gas containing sulfur dioxide. It consists of a combined scrubbing-cooling tower, four mist precipitators, a drying tower and a heat exchanger-catalyst bed system. The gas cooling-scrubbing system uses 65 to 80% sulfuric acid as the cooling-scrubbing medium.

35050 **APTIC NO. 58866**

Biswas, A. K., N. C. Roy, and M. N. Rao

CONVERSION OF WASTE SULPHUR DIOXIDE INTO SULPHUR AND CARBON DISULPHIDE. *Indian J. Technol. (India), 6(5):157-158, May 1968. 7 refs.*

The reduction of sulfur dioxide obtained in the metallurgy of sulfur containing ores into sulfur and carbon disulfides was investigated using an integral flow reactor with a fixed bed of charcoal or coke. After an initial lag period of three hours, the conversion of SO2 to CS2 shows a sudden increase due possibly to the activation of the carbon source. The results also indicate that sodium carbonate acts as a catalyst for this reaction. (Author summary)

35051 **APTIC NO. 58194**

Buenning, K.

METHODS FOR DESULFURIZATION OF GASES. 147. MEETING OF THE GERMAN ASSOCIATION FOR CHEMICAL EQUIPMENT (DECHEMA) ON OCTOBER 11 IN FRANKFURT. *(Verfahren zum Entschwefeln von Gasen. 147. Dechema-Kolloquium am 11. Oktober in frankfurt). Text in German. Brennstoff-Waerme-Kraft, 20(12):588, Dec. 1968.*

At the meeting of the German Association for Chemical Equipment (DECHEMA), two papers were presented. The first paper dealt with desulfurization of natural gas. The methods available can be divided into two groups: the first one comprises all methods of adsorption in a fixed bed, and the second comprises absorption by gas scrubbing. Adsorption methods are applicable at low hydrogen sulfide concentrations. The gas is passed through iron oxide or through a molecular sieve. For removal of organic sulfur, activated coal is used. For higher hydrogen sulfide concentrations, scrubbing methods must be employed. Adsorption and scrubbing costs are discussed. The second paper dealt with dry methods to remove SO2 from waste gases. The dry methods usually operate at a temperature range above the dew point. The gas is either passed through a zone of SO2 binding agents, or the reagent is brought into contact with the gas in a fluidized bed. Dolomite or calcium injection into the flue gas duct of the boiler seems to be the method of the future since it requires almost no extra installations. Morever, a highly reactive coke has been marketed recently which adsorbs SO2 at temperatures between 60 and 250 C.

35052 **APTIC NO. 58088**

Burkhardt, Donald B.

SULFUR TRIOXIDE PRODUCTION. *(Assignee not given.) U. S. Pat. 3,362,786. 4p., Jan. 9, 1968. 3 refs. (Appl. Oct. 5, 1965, 18 claims).*

A process is described for the production of sulfur trioxide from gases containing oxygen and 4 to 30% sulfur dioxide by volume. The catalytic oxidation of SO2 to SO3 takes place in two or more stages followed by an intermediate absorption of the SO3 by a selective absorbent consisting of compounds containing vanadium and alkali metal sulfates between 350 and 500 C prior to the last catalytic stage. Catalysis is carried out without an external heat source, and the last stage does not involve heating by gases from previous stages. The remaining SO2 in the gas stream is oxidized to SO3 by passing it through one or more catalyst stages, eliminating the necessity of cooling the gas prior to entry and reheating it on exit from the intermediate absorption step. Conversions of 99% or higher are possible with this process since the thermodynamic equilibrium limits are favorably altered by the resulting improvement in the O2/SO2 ratio of gas leaving the intermediate absorption step. The process is also capable of producing relatively pure, high-strength SO3 in gas, liquid, or solid state.

35053 **APTIC NO. 58017**

Grigoryan, R. V. and G. O. Grigoryan

CALCINING OF KAFAN PYRITE IN A BOILING LAYER FURNACE AND ABSORPTION OF SULFUR DIOXIDE WITH WATER. III. ABSORPTION OF SULFUR DIOXIDE BY WATER IN A BUBBLING APPARATUS WITH GRID PLATES. *(Issledovaniye protsessa obzhiga kafanskogo kolchedana v pechi kipyashchego sloya i absorbtsii sernistogo gaza vodoy. III. Issledovaniye protsessa absorbtsii sernistogo gaza vodoy v barbotazhniykh apparatakh s proval nymi tarelkami). Text in Russian. Army. Khim. Zh. (Erevan), 21(5):440-446, 1968. 11 refs.*

Water absorption of sulfur dioxide was studied in laboratory, pilot, and industrial test equipment employing grid plates. The effect of basic variables on mass transfer was examined. With SO2 concentration below 2%, the absorption coefficient was two to three times higher than the mass transfer coefficient during desorption; but when the concentration was greater than 2%, these values practically coincide. Verification of the additivity of phase resistances revealed the possibility of generalizing experimental data through solution of derived dimensionless equations for the liquid and gaseous phases, and subsequent solution of a general mass transfer equation. A general dimensionless equation for direct calculation of the process of SO2 absorption by water is derived using common coefficients of mass transfer on the basis of interphase turbulence theory.

35054 **APTIC NO. 58018**

Habashi, Fathi and Nestor Torres-Acuna

THE ANODIC DISSOLUTION OF COPPER (I) SULFIDE AND THE DIRECT RECOVERY OF COPPER AND ELEMENTAL SULFUR FROM WHITE METAL. *Trans. AIME (Am. Inst. Mining, Metallurgical and Petroleum Engr.), 242(5):780-878, May 1968. 32 refs.*

Metallic copper of purity equal to commercial electrolytic copper is deposited during the anodic dissolution of white metal, copper sulfide, in an acidic solution of copper sulfate as electrolyte and copper sheets as cathodes. The process may be applied on the commercial scale since it has the advantage of bypassing the converting and poling steps, decreasing pollution problems due to sulfur dioxide, and recovering the sulfur of white metal in the elemental form. The anodic dissolution takes place in three steps: during the first 3 hours of electrolysis, the whole surface of the anode is converted to digenite (no slimes are formed, but the surface of the anode changes its color from gray to dark blue); after 4 hours of electrolysis the digenite yields copper, sulfur, and cupric sulfide; the cupric sulfide formed in the second reaction decomposes to yield copper and elemental sulfur which contributes to the sharp rise in sulfur content in slimes. A steady state if reached after about 10 hours, and the three reactions proceed continuously at a constant rate.

35055 **APTIC NO. 58200**

Haupt, C. G.

EXHAUST EMISSION BY A SMALL GAS TURBINE. *Preprint, Society of Automotive Engineers, Inc., New York, 6p., 1968. 12 refs. (Presented at the Society of Automotive Engineers, Mid-Year Meeting, Detroit, Mich., May 20-24, 1968, Paper 680463.)*

Exhaust emissions from a single shaft, nonregenerative, 90 hp gas turbine were measured at no load, two-third load, and full load operation on two fuels, regular kerosene and 1% wt sulfur gas oil. There were then analyzed for sulfur dioxide, sulfur trioxide, nitrogen oxides, unburned hydrocarbons (hexane), aldehydes (formaldehyde), and exhaust solids. Additionally, the carbon monoxide content of the exhaust gases was continually monitored as an indication of possible changes in the engine combustion performance. Concentration levels of the various constituents at varying engine loads for each of the two fuels are tabulated. The continuous nature and the possibility of greater control of combustion conditions in the gas turbine compared to other types of internal combustion engines make it potentially capable of operating with lower levels of undesirable exhaust constituents. Although generalizations concerning all gas turbines cannot be made from the results of one relatively simple engine, favorable comparisons to other types of engines illustrate the potential superiority of the turbine in this area. (Author abstract modified)

35056 **APTIC NO. 58056**

Kalmykov, A. V. and M. T. Gubanov

UNIFLOW BATTERY DUST CATCHERS. *Coke Chem. (USSR) (English translation from Russian of: Koks. i Khim.), no. 5:8-12, 1968.*

Dust catching systems presently in use in Soviet drying plants are reviewed in detail, explaining operation and showing how the procedures failed to clean dust-laden gas to meet the health standards required. An alternative and more successful system developed by the Institute of Mineral Fuels in collaboration with Gipromashugleobogashchenie is presented. This dust catcher incorporated a uniflow battery catcher (diagram included) and a wet dust catcher and contained two types of despiralling suction helices. The use of this system substantially reduced hydraulic resistance of the tube drier, doubled the dust catching efficiency, and enabled much more concentrated dust and ash to be trapped in dry form.

35057 **APTIC NO. 58011**

Knop, Wilhelm

SOOT PRODUCTION AND CLEAN AIR MAINTENANCE. *(Russherstellung und Luftreinhaltung). Text in German. Wasser Luft Betrieb, 12(9): 536-539, Sept. 1968. 6 refs.*

A description of industrial methods of production, separation, and treatment of various kinds of soot is followed by a detailed consideration of methods for minimizing air pollution by soot and waste gases. Waste gas leaving cyclone and/or bag filters in which soot is retained, contains residual soot and gases. Soot particles are removed by afterburning at 1100 C, as well as by scrubbing. Treatment of soot in rotary drying kilns for production of soot granules, in roll presses for compacting, and in transporting, storing and bag-filling operations contaminates the air within the plant. Raw materials responsible for soot production contain up to 2% of sulfur dioxide, and the waste gas contains up to 1.5% SO2. Air displaced from raw material storage tanks during filling has an objectionable odor which is eliminated by an active charcoal filter before its release into the atmosphere. Measuring instruments are necessary to ascertain the effectiveness of soot control devices. A test using three different measuring devices: Bacharach, Visomat, and Sick in the stack of a soot plant in the Frankfurt am Main district is described.

35058 **APTIC NO. 58085**

Lenz, Hans Peter

ON THE DEVELOPMENT OF ALTITUDE COMPENSATORS FOR CARBURETORS OF OTTO ENGINES. *(Zur Entwicklung von Hoehenkorrektoren fuer Vergaser von Ottomotoren). Text in German. VDI (Ver. Deut. Ingr.) Z. (Duesseldorf), 110(22):1004, Aug. 1968.*

Fuel consumption and the quality of the exhaust gas can be improved by the use of altitude compensators. If the expansion of the air and the changes of the throughput number in the carburetor are neglected, the changes of the fuel-ratio are approximately proportional to the square root of the change of air density. Since the air-fuel ratio is adjusted by the underpressure created by the motor, the decreasing density of the air at higher altitude decreases the underpressure in the carburetor and thereby increases the fuel-air ratio. This causes uneconomical fuel consumption and increased exhaust pollution. Now, for the first time, the new production series of an automobile (VW 1600 automatic) is equipped with an altitude corrector. It consists of bellows which expand according to the outside pressure and thus adjust a dosing needle which controls the fuel flow.

35059 **APTIC NO. 58097**

Lundgren, D. A. and V. W. Greene

FILTRATION AND DUSTS CONTROL EQUIPMENT IN THE PRODUCTION OF CONTROLLED AIR ENVIRONMENTS. *Filtration Separation (Purley), 5(5):405-412, Sept./Oct. 1968. 9 refs.*

Selection of an air cleaning system depends on the type of air flow present. For laminar flow, the application of gas cleaning devices other than absolute filters is limited. Two-stage electrostatic precipitators and venturi scrubbers can be used when followed by absolute-type filters. For turbulent flow, electrostatic precipitators have the advantage of low pressure drop and low operating cost. Cloth filters perform as well as absolute filters, but their operating cost is higher. If the removal of both gases and particulates is required, venturi scrubbers are the preferable method, although higher operating costs result. Microbes are a very small fraction of the total particulate matter in air, but because of their reproductive-infective ability, they should be controlled with filters, electrostatic precipitators, air washers, or scrubbers.

35060 **APTIC NO. 57838**

McLaren, J.

FLUIDIZED BED COMBUSTION. *Energy Int., 1968:12-13, March 1968.*

A fluidized bed combustion technique for steam generation in which particulate coal is burned in a fluidized bed of coal ash and/or refractory at an elevated temperature promises high efficiencies and reduced costs. There are two principle methods of using the heat so generated. The first is to use the bed as a furnace to produce radiant and convective heat; the second incorporates heat transfer surfaces immersed in the fluidized bed, making use of the high heat transfer coefficients that are available in this area. Advantages of immersing the heat transfer surfaces include lower capital costs and less stringent requirements on fuel size. The relatively low temperature in a fluidized combustion bed reduces corrosion due to volatilization and condensation of alkali salts. Experiments using a 3 in. diameter bed of ash showed that combustion was complete in a 2 ft deep bed at 800 C with 5% excess air. Carbon monoxide content in the exit gas was less than 0.1% by volume. There was no evidence of methane or other combustible gases. The C content was less than 0.1% when using a coal of 20% ash content.

35061 **APTIC NO. 57840**

Merrion, David F.

EFFECT OF DESIGN REVISIONS ON TWO STROKE CYCLE DIESEL ENGINE EXHAUST. *Preprint, Society of Automotive Engineers, Inc., New York, 10p., 1968. 18 refs. (Presented at the Society of Automotive Engineers, Mid-Year Meeting, Detroit, Mich., May 20-24, 1968, Paper 680422.)*

The exhaust emissions of the 6V-71E and 6V-71N engines used in transit coaches were compared to illustrate that design revisions can affect diesel exhaust. Carbon monoxide and sulfur dioxide emissions depended upon fuel-air ratio. Carbon monoxide emission from a diesel engine is relatively low; sulfur dioxide formation depends upon the quantity of sulfur in the fuel. The design revisions of increased compression ratio and improved injection system increased emitted nitrogen oxides and decreased aldehydes and hydrocarbons. Exhaust smoke, measured by a filtering meter on engine dynamometer tests by a sampling light extinction meter on road tests, and by a full-flow light extinction meter on chassis dynamometer tests, was reduced after design revisions during both steady state and transient conditions. Exhaust odor, measured by a sniff-box technique and a psychological scale by a threshold technique using natural distillation in a large building, and by a sniff-tube dilution technique using the Turk bottle rating, was also reduced with the design revisions at various dilution ratios and under steady state and transient conditions.

35062 **APTIC NO. 57998**

Miller, M. R. and H. J. Wilhoyte

STUDY ON CATALYTIC SUPPORTS IN REDUCING SMOKES EMITTED BY HYDROCARBON SOLVENTS. *(Studio su sistemi di supporti per catalizzatori nella riduzione dei fumi di solventi a base di idrocarburi). Text in Italian. Rass. Chim., 20(6):281-286, Nov./Dec. 1968. 8 refs.*

Research was conducted in a pilot plant manufacturing stainless steel to determine how catalytic supports affects smoke reduction. The production process employed thermic incineration associated with catalytic oxidation of smokes emitted by solvents. The catalytic supports tested were small ceramic balls, metallic spiral sheets, and honeycomb structures. In all the tests, noble metal catalysts were used. The data showed a space speed ranging from 30,000 to 175,000 standard cu ft per hr and per cu ft of catalytic bed. Catalytic reactor temperature ranged from 150 to 450 C. The optimum result in smoke reduction was obtained by connecting thermic incineration to catalytic oxidation. The support geometry had a great influence on reduction apparatus performance.

35063 **APTIC NO. 57903**

Niitsu, Yasushi, Akira Yoshikawa, and Kooichi Nakabayashi

RESEARCHES ON ELIMINATION OF SULPHUR DIOXIDE. *Trans. Soc. Heating Air Conditioning and Sanitary Engrs. (Japan), vol. 6:32- 40, 1968. 2 refs.*

Sulfur dioxide elimination, by adsorption and by washing with water, is discussed. The relationship between the efficiency of air purification and various factors such as bed thickness, face velocity, and SO2 concentration in the inlet air was studied by adsorption into activated carbon. The effects of the air-water ratio, the relation of tower height to air purity, and the contamination of water were investigated for elimination by washing. For air conditioning, the gas concentration ratio at the front of and behind the bed of activated carbon has little relation with face velocities. The factors which most affect the efficiency of air purification by washing are air-water ratio and the height of the packing column. Efficiency of air purification decreases with an increase in air-water ratio. The most economic height of packing material is 2 m. In cases where the water circulates in the column, rapid contamination of washing water occurs, resulting in corrosion of the tower. It is believed that the washing method by water is very effective for the purification of atmospheric air.

35064 **APTIC NO. 57970**

Parpart, J.

DUST COLLECTORS FOR THE CEMENT AND LIME INDUSTRY. *(Entstauber fur die Zement- und Kalkindustrie). Text in German. Zement-Kalk-Gips (Wiesbaden), 57(7):297-298, July 1968.*

Dust collectors in the cement and lime industry are discussed. Numerous decisive factors in the selection of a collector are mentioned. For instance, if the dust particles are not below 10 micron the relatively inexpensive centrifugal separator suffines, or if the cloth filter is loaded with a dirty gas of more than 100 g dust/cu m, it might be of advantage to install some centrifugal separators to reduce the strain on the cloth. A specific load of 1 cu m/sq m/min proved to be of ad antage for cloth filters. Centrifugal separators are generally designed for 60 to 80 kg force/sq m. The gas temperature for cloth filters may not be higher than 130 C. At higher temperatures, glass fiber and other mineral filter media must be used. A cost comparision of the various dust collectors shows that investment costs run highest for the dry electrostatic precipitator; its operating costs, however, are as low as those of mechanical collectors.

35065 **APTIC NO. 57984**

Pisarev, V. A. and L. S. Muromtseva

SORPTION OF SULFUR DIOXIDE BY SYNTHETIC RESINS. *J. Appl. Chem. (USSR) (English translation from Russian of: Zh. Prikl. Khim.), 41(9):1974-1976, Sept. 1968. 6 refs.*

The problem of removing sulfur dioxide from gases led to the investigation of synthetic resins as sorbents. Preheated air was humidified and entered a heat exchanger which created and maintained a constant temperature in the system. It was then mixed with sulfur dioxide in a mixer. The gas-air stream then entered a column containing the ion exchange resin. The SO2 contents before and after adsorption were determined iodimetrically. The hydroxide and carbonate forms of synthetic resin have considerable sorption capacity for SO2. A highly basic anion exchanger saturated with SO2 has been regenerated by water after which it regains its original capacity. However, the anion exchanger studied in this experiment could not be regenerated with water. Gases can be purified at temperatures not exceeding 50 C, with relatively low breakthrough of SO2, with the aid of ion exchangers as sorbents for SO2.

35066 **APTIC NO. 58855**

Sawyer, R. F. and E. S. Starkman

GAS TURBINE EXHAUST EMISSIONS. *(Preprint, Society of Autmotive Engineers, 8p., 1968. 6 refs. (Presented at the Society of Automotive Engineers, Mid-Year Meeting, Detroit, Mich., May 20-24, 1968, Paper 680462.)*

Emission levels reported with respect to fuel consumption show that exhaust emissions, with the exception of nitric oxide, for a wide variety of gas turbine engines are at levels below present and projected air pollution standards. Experimental data on emission levells of carbon monoxide, hydrocarbons, and nitrogen oxides are reviewed and compared. Nitric oxide concentrations approached, and in one case exceeded, proposed motor vehicle standards of 350 ppm. The concentration of NO emissions is controlled by kinetic phenomena, and a proposed kinetic process to control the level of emission appears feasible.

35067 **APTIC NO. 57969**

Schwanecke, Rudolf

AIR POLLUTION CONTROL: PROBLEMS WITH DEPRESSURIZING-AND SAFETY VALVES. *(Luftreinhaltung: Probleme bei Entspannungs- und Sicherheits-ventilsystemen), Text in German. Wasser Luft Betrieb, 12(7):436-439, July 1968. 17 refs.*

There are three types of depressurizing and safety valves: those which empty through short ducts directly into the atmosphere or via blowdown drums (for heavier vapors), those which carry toxic and odorous gases to cleaning plants while all non-toxic and non-odorous products are discharged directly into the atmosphere, and those which carry all gaseous and liquid substances to incinerators or cleaning systems. The first method of discharging directly into the atmosphere without prior cleaning is no longer acceptable because it burdens the atmosphere with intolerably high hydrocarbon concentrations. The third method of connecting all valves with air pollution control systems is too costly, but there is no doubt that it is the best method with respect to air pollution control. The main reasons for using open valve systems which discharge into the atmosphere are their simple design and smaller size, no counterpressure to be taken into account, and easy determination of the reaction forces acting on valves and discharge ducts. With closed valve systems which are connected to some sort of air pollution control device, certain problems have to be overcome. In the waste gas manifold, for instance, there are rarely static pressure conditions. The gases pass through the pipe system irregularly and, as a consequence, temperature and pressure fluctuate widely. As far as the safety valves of liquid gas tanks are concerned, it is difficult to decide whether or not to connect them with air pollution control facilities. Careful considerations lead to the conclusion to let such valves discharge directly into the atmosphere.

35068 **APTIC NO. 58851**

Sekine, Takashi

THE PROPERTIES ON THE AIR FILTER FOR THE HOT DUSTS. *(Kokunae kosaino fairuto no [illegible]), Text in Japanese. Kuki Seijo (Clean Air-J. Japan Air Cleaning Assoc., Tokyo), 6(4):48-50, Oct. 1968.*

All high-efficiency filters made in Japan are combustible. However, it was experimentally determined that a high-efficiency filter could be placed under a hot dust stream with no change in filter efficiency. This was accomplished by placing a glass wood prefilter 1 m downward from the gas stream between a high-efficiency filter made of asbestos, glass wool, and cellulose, and the smoke source. Although the maximum temperature in front of the prefilter reached 210 C and the mean temperature in front of the high-efficiency filter reached 105 C, filtration efficiency was about 99.97%.

35069 **APTIC NO. 57816**

Sepper, A. M. and V. V. Lugovoi

IMPPROVING THE PERFORMANCE OF DUST REMOVAL EQUIPMENT. *Coke Chem. (USSR) (English translation from Russian of: Koks i Khim.), no. 10, 1968, p. 44-47.*

Improved dust removal equipment is described which consists of a centrifugal dust fan used with a wet dust collector-filter. A drip collector also operates in conjunction with the fan. In a laboratory study, the performance of the dust collecting unit was assessed in terms of the absolute value of the dust content of the clean air and the degree of dust collection in the collector. The absolute value of the dust content of the clean air increased as the dust concentration at the fan inlet increased. The efficiency of the unit varied between 96.8 and 99.9% for coal dust depending on the operating conditions. The injection of water into the drip collector greatly improved the air cleaning process, particularly the removal of finely dispersed dust fractions, almost none of which are recovered by the fan filter. The fan filter is recommended for widescale use in coal preparation and cleaning plants and coke screening stations at coke and chemical undertakings.

35070 **APTIC NO. 58839**

Sun, S. C. and K. I. Savage

FLOTATION RECOVERY OF PYRITE FROM BITUMINOUS COAL REFUSE. *Trans. AIME (Am. Inst. Mining, Metallurgical and Petroleum Engr.), vol. 241:377-384, Dec. 1968. 8 refs. (Presented at the AIME, Annual Meeting, New York, Feb. 25-29, 1968.)*

A new process has been developed to recover coal, clays, and pyrite from coal wastes. The process consists of fine grinding followed by coal and pyrite flotation which leaves the clays in the flotation pulp. Yield for the process in treating a bituminous coal refuse containing 10% sulfur and 30% pyrite product containing 45% S and 1% carbonaceous material, and a clay product containing 2% S. Coal and pyrite yields were 89 and 77%, respectively. Pyrite to coal ratio in the flotation feed may be increased by gravity separation. Estimated costs for the process in 1968, excluding labor, maintenance, overhead, and depreciation, show a profit of $2.28 per ton of low-grade refuse. The waste clay and pyrite can be used in various industries.

35071 APTIC NO. 58652

Suzuki, Isamu

BAG FILTER SYSTEMS FOR EQUIPMENT OF INDUSTRIAL HYGIENE. *(Rodo kankyo kaizenyo baggu fuiruta). Text in Japanese. Kuki Seijo (Clean Air-J. Japan Air Cleaning Assoc., Tokyo), 6(2):35-39, June 1968.*

Bag filters have applications for industrial hygiene, pollution control, airborne dust collection, and by-product recovery. Their design depends on pressure, temperature, and characteristics of the processing gas; particle characteristics; input dust concentration; filtration rate; filtration velocity; space available for a bag filter plant; and processing after dust collection. Each of the five standard bag filters produced by the Shazin-Suchi company can be adapted to a range of filtration areas. The company also produces five mechanisms for draining the collected dust. The key point in choosing a filter is the determination of the gas flow rate.

35072 APTIC NO. 58628

Suzuki, Shoichi

ABOUT BAG FILTERS. *(Bagu fuiruta ni tsuite). Text in Japanese. Kuki Seijo (Clean Air-J. Japan Air Cleaning Assoc., Tokyo), 6(2):40-42, June 1968.*

The jet and the therm dust collectors exemplify reverse jet and reverse air flow types of bag filters. Dust is collected outside the first filter before being introduced inside by the reverse jet air from an oscillating jet ring. The operation is continuous, and a filtration rate of 3 to 6 m/min is possible. When a diaphragm pressure switch is used to determine filtration resistance, cleaning becomes automatic. The collector is appropriate for temperatures below 80 C. It has applications for air separation apparatus, furnace blowers, and gas engine air feeders. The glass fiber bag of the therm collector is opened and closed by the operation of two dampers. Efficiency of dust collection is more than 99%. The filter is used for ventilating furnace gases where air temperature reaches 260 C.

35073 APTIC NO. 58031

Tamura, Zensuke and Yukio Hishinuma

METHOD OF AND APPARATUS FOR DESULFURIZING INDUSTRIAL WASTE GASES. *(Hitachi, Ltd., Tokyo (Japan)) U. S. Pat. 3,398,509. 4p., Aug. 27, 1968. 4 refs. (Appl. Aug. 15, 1967, 6 claims).*

A method of absorbing sulfur oxides from industrial gases by active carbon is described. The adsorption takes place in a desulfurization tower which has a low temperature adsorption zone, a high temperature adsorption zone, a desorption zone, and a cooling zone. Nitrogen or carbon dioxide gas, heated to about 400 C, is used for the desorption process. After the active carbon particles has been cooled by jets of water, they are returned to the low temperature adsorption zone for reuse.

35074 APTIC NO. 57893

Warren, D. R.

FUEL CELLS AND THEIR PROSPECTS AS SOURCES OF AUTOMOTIVE POWER. *SAE-Australasia, 29(1):14-21, 1968. 11 refs. (Presented at the Society of Automotive Engineers, New Zealand, Oct. 15, 1968, Paper 6.)*

The growing concern about air pollution has placed an increasing pressure on the development of nonpolluting energy sources for automobiles. High among the contenders is the fuel cell which converts the chemical energy of a fuel into electrical energy without passing through a heat stage. The ideal fuel cell will consume relatively cheap fuel available in abundant supply. Its effluent should be nonpolluting, and it should start quickly and respond to surges in load. Of the prospective high energy storage systems under development, the rechargeable zinc/air semi-fuel-cell is attractive because it requires no pre-heating, and if involved in an accident, it can only deliver energy as fast as air is supplied to it, not explosively. The attention given to the development of an electric automobile will be conditioned largely by the efforts to eradicate the pollution problems of the internal combustion engine.

35075 APTIC NO. 58837

Wheelock, T. D. and D. R. Boylan

SULFURIC ACID FROM CALCIUM SULFATE. *Chem. Eng. Progr., 64(11):87-92, Nov. 1968. 11 refs.*

A new process for producing sulfuric acid and lime (not cement) from either gypsum or anhydrite was presented. The key steps in the process consisted of heating calcium sulfate particles to high temperature in the presence of reducing gases to produce sulfur dioxide and lime, cooling and cleaning the gas, and converting SO2 to sulfuric acid via the normal contact process. The underlying physicochemical principles were reviewed and a preliminary process design was presented. Estimates of the fixed capital and production costs of plants capable of producing 300 to 1200 tons/day of acid were compared with corresponding costs of regular sulfur burning plants. All data are tabulated, and a flow sheet is included for the calcium sulfate decomposition and gas purification sections of the plant.

35076 APTIC NO. 58893

Zentgraf, Karl-Martin

LARGE-SCALE EXPERIMENTS FOR DESULFURIZATION OF POWER PLANT WASTE GASES. *(Grosstechnische Versuche zur Entschwefelung von Kraftwerksabgasen). Text in German. Umschau (Frankfurt), 68(19):601, Sept. 1968.*

In the Federal Republic of Germany about 5.4 million tons of sulfur dioxide annually are emitted into the atmosphere. In terms of elementary sulfur, this represents 2.7 million tons. The industrial sulfur consumption per year is only 1.6 million tons. Electric power plants contribute 35% to the sulfur dioxide emissions. In Essen, four desulfurization methods are presently being tested in scaled-down models or by experiments in large plants. Experiments with the additive method, where pulverized lime products are injected into the boiler, showed that only 30% of the sulfur can be removed. It can be used as stand-by method at smog alert stage II (when several measuring stations record a concentration of 5 mg SO2/cu m air). The second method is also based on the additive method, but in this case the injected lime products are washed out together with the fly dust. In this scrubbing process more SO2 is absorbed. In the Reinluft process, SO2 is adsorbed by circulating coke. After adsorption the coke is regenerated and yields a gas with a high SO2 concentration. In the Still process, the flue gases are desulfurized in a fluidized bed with calcium hydrate or hydrated brown coal ash. The sulfur dioxides are bound to calcium sulfite, which can be dumped.

1967

35077 APTIC NO. 57982

Jones, W. J. and R. A. Ross

THE SORPTION OF SULFUR DIOXIDE ON SILICA GEL. *J. Chem. Soc. A, 1967:1021-1026, 1967. 13 refs.*

The adsorption of sulfur-containing gas was examined with emphasis on the simplest gases which are commonly found as atmospheric impurities from industry. The sorption of such gases on solid adsorbents is one obvious possible method of sulfur recovery. Adsorption isotherms of sulfur dioxide on silica xerogels were determined by the quartz spring method from 263-323 K. High- purity xerogels were used after various degrees of heat treatment and were characterized by low-temperature nitrogen adsorption and by density measurement through immersion in mercury. Comparative isotherms were measured at 263 K on commercial silica gels of widely different surface characteristics. Heats of adsorption were determined from isosteres for the monolayer region and showed a steady decrease with increasing surface coverage from 9.3 to 7.8 kcal/mole. The sorption process was discussed in terms of a physical model.

35078 **APTIC NO. 57985**

Kurtzrock, R. C., D. H. McCrea, and G. J. Cinquegrane

DESIGNING AN ALKALIZED ALUMINA PILOT PLANT FOR SULFUR OXIDES REMOVAL. *Preprint, American Inst. of Mining, Metallurgical, and Petroleum Engineers, Metallurgical Society, 19p. 5 refs. (Presented at the American Institute of Mining, Metallurgical, and Petroleum Engineers, Metallurgical Society, Operating, Metallurgy Conference, Chicago, Ill., Dec. 11-15, 1967.)*

A process for removing sulfur oxides from hot flue gases is discussed. Removal is effective at low concentrations and is accomplished without cooling the gases. The gases are scrubbed by alkalized alumina, a regenerative dry chemical absorbent. Sulfur dioxide and oxygen in the flue gas react with the absorbent, forming a sulfate, and the spent absorbent is regenerated at 1200 F by contact with a reducing gas such as reformed natural gas, hydrogen, or producer gas. The sulfate is reduced to hydrogen sulfide and removed in the regenerator effluent, which is then processed for recovery of elemental sulfur, using standard processing techniques such as the Claus system. A complete description of the facility is included, and mechanical problems, such as feeding and conveying absorbent without crushing particles, and separating absorbent from the flue gases, are described.

35079 **APTIC NO. 58020**

Zentgraf, K. M.

PRESENT STATE OF THE DESULPHURISATION OF WASTE GAS BY THE LIMESTONE-DOLOMITE-PROCESS IN COAL DUST FIRED BOILERS IN GERMANY. *Preprint, 51p., 1967. (Presented at the Limestone Symposium, 3rd., Clearwater, Fla., Dec. 4-8, 1967.)*

Investigations of the limestone-dolomite process for removing sulfur dioxide from flue gases are discussed. These tests were carried ou in a wet-bottom boiler, which differs from dry-bottom boiler in that much higher flue gas temperatures are obtained and it is normally operated with recirculated fly ash. The best point of injection of the desulfurizing agent was determined by means of dolomite hydrate, and was that point where the flue gas temperature was 1500 C. Of the different desulfurizing agents used, limestone dust was the best, with caustic lime the most inactive. The degree of desulfurization was proportionally related to the quantity of desulfurizers. The desulfurizer must be distributed in such a way that no more material exists than is necessary according to the proportionality between the degree of desulfurization and the quantity of material. To determine the degree of desulfurization, the sulfate content of collected dust was investigated. This process is dependent on the residende time at a constant flue gas temperature of 750 C. The problem of dust emission during the process remains. Factors influencing this are the degree of binding in the combustion chamber, the separation efficiency of the filter, the type of fuel, especially the ash contents, and the injected quantities of desulfurizing matter. Limestone additionally blown into the boiler can be separated much more easily than the normal fly ash, and in this way dust emission can be lowered.

35080 **APTIC NO. [illegible]**

(Inventor not given.)

IMPROVEMENTS IN OR RELATING TO THE REMOVAL OF SULPHUR DIOXIDE FROM GASES. *(Bergwerksverband G.m.b.H. Essen (West Germany)) Brit. Pat. 1,090,306. 4p., Nov. 8, 1967. (Appl. Sept. 9, 1966, 5 claims).*

A process for removal of sulfur dioxide from smoke and industrial waste gases is described. Sulfur dioxide waste is removed by an adsorbent consisting of carbon impregnated with 0.1 to 15% by weight of iodides and/or iodates. The reaction occurs best at 100 to 160 C. After adsorption, the gas is first oxidized to sulfur trioxide by oxygen present in the waste gases and then converted to sulfuric acid with the water vapor also present in the gases. Sulfuric acid is removed and the adsorbent is regenerated by washing with ammonia water.

35081 **APTIC NO. [illegible]**

THE WELLMAN-LORD SO2 RECOVERY PROCESS. *Sulphur, no. 73:24-27, Nov./Dec. 1967.*

The Wellman-Lord sulfur dioxide recovery process was conceived in mid-1966 and patents are pending, so that only details relative to process performance, SO2 utilization, process economics, and logistics analyses are available to date. The process can be applied to any SO2-bearing effluent gas from a fossil fuel source. Sulfur dioxide is removed in the form of a liquid, elemental sulfur or sulfuric acid, and sulfur trioxide and particulate matter are completely removed. Studies based on a 500 MW and a 1500 MW power station are reported in terms of economics. The coal used contained 3 and 4% sulfur. The average power rate change required to cover 1967 costs of SO2 recovery in mills/kWh are: +0.08 using 3% S-coal and 0.0 using 4% S-coal in the 500 MW station; and -0.04 using 3% S-coal and -0.12 using 4% S-coal in the 1500 MW station.

1966

35082 **APTIC NO. 58006**

Hulteberg, Arne

SOME EXPERIENCES WITH HIGH YIELD MAGNESIUM BASE SULPHITE PULPING AT HALLSTAVIK. *Paper Trade J., 150(28):58-60, July 11, 1966.*

The conversion from calcium to magnesium base pulp for newsprint is discussed. The first trail was on a small scale basis with no major changes made in the sulfite mill. Results indicated that the magnesium base pulp had a higher tear factor and a better burst factor with 8% higher brightness, so larger scale trial was was attempted. The acid preparation system was completely rebuilt and an electrostatic precipitator was used for the recovery of magnesium oxide. The cooks were carried out at an end temperature of 145 to 150 C and an end pressure of 6 atm. Better impregnation was accomplished and a cleaner pulp obtained, but brightness dropped 49 to 50%. Estimates of 1966 costs showed the magnesium pulp to be more expensive than calcium pulp, and the lower wood consumption did not compensate for the additional cost. It is hoped that cooking modifications can improve brightness and that costs can be lowered by improvements in the production of the cooking acid.

35083 **APTIC NO. 58010**

Johswich, Friedrich

METHOD OF AND APPARATUS FOR REMOVING SULFUR COMPOUNDS FROM GASES. *(Reinluft G.m.b.H. Essen (West Germany)) U. S. Pat. 3,284,158. 6p., Nov. 8, 1966. 4 refs. (Appl. March 23, 1964, 9 claims).*

The gas stream is contacted with a solid carbonaceous adsorbent in the presence of an oxidizing agent at a temperature in excess of 50 C and sulfficient to oxidize all the reducing sulfur compounds to elemental sulfur, sulfur dioxide, or sulfur trioxide. The resulting oxidizing sulfur compounds are adsorbed by the carbonaceous agent and sulfuric acid is deposited. The agent is heated to 300-500 C for a period of time sufficient to convert elemental sulfur, H2SO4, and oxidizing sulfur compounds to SO2, which is then removed from the adsorbent. A simple and inexpensive process is described from the simultaneous extraction of oxidizing and reducing sulfur compounds from industrial gases, such that only SO2 appears as a product. The method is especially effective at relatively low sulfur concentrations, i.e., below 10% by volume. By maintaining a molar ratio from 1.1:1.0 to 3.5:1.0 between the oxidizing sulfur compounds and the reducing sulfur compounds, it is possible to carry out the reaction series to completion and produce sulfur dioxide without contamination of the adsorbent by residual elemental sulfur after the desorption step.

35084 **APTIC NO. 58882**

Kiyoura, Raisaku

STUDIES ON THE REMOVAL OF SULFUR DIOXIDE FROM HOT FLUE GASES TO PREVENT AIR POLLUTION. *J. Air Pollution Control Assoc., 16(9):488-489, Sept. 1966. 2 refs.*

Sulfur dioxide in flue gas is oxidized to sulfur trioxide in the presence of vanadium oxide according to the Kiyoura-T.I.T. process. Water vapor present in the flue gas reacts with sulfur trioxide to form sulfuric acid, after which ammonia is introduced for the formation of ammonium sulfate. The ammonium sulfate produced is of the ideal size for removal by electrostatic precipitator or dry cyclone separator. The ammonia sulfate can be used as a fertilizer. A pilot plant is being tested.

35085 **APTIC NO. 58034**

Van Luven, A. L.

SURVEY OF PRIMARY PLANTS FOR KRAFT EFFLUENTS. *Pulp Paper Mag. Can. (Quebec), 67(2):T-83-T-90, Feb. 1966. 29 refs.*

The kraft pulping industry has achieved significant improvements in mill efficiency and reduction of waste. The present trends in primary treatment are: replacement of lagoons; establishment of adequate data; installation of separate sewer systems for controlled treatment; neutralizing the waste; and dewatering the sludge and possibly incinerating it with bark. There are several methods for controlling odors in kraft mills, including black liquor oxidation, combustion, and scrubbing. The odor from a recovery furnace is due to the direct contact between stack gases and black liquor. The carbon dioxide in the stack gas reacts with the hydrolysis products of the sodium sulfide in black liquor, forming hydrogen sulfide and sodium carbonate. The application of black liquor oxidation reduces the amount of sulfides emitted by 90%, and may effect sulfur savings up to 32 lbs/ton.

1964

35086 **APTIC NO. 58059**

Chen, W. L.

CYCLONES WITH PLAIN WATER FOR FINE-COAL CLEANING. *Coal Age, 69(8):90-92, Aug. 1964. 12 refs.*

The hydrocyclone is a hydraulic cyclone which uses water only for thickening, classification, and cleaning in preparation plants. The unit consists of feed and discharge ports, cylindrical body, a conical section with apex opening, and a vortex finder with partition dividing feed from clean-coal overflow. Because of the movement of material through the hydrocyclone, the overflow through the vortex is always clean coal with an insignificant amount of sink material. Hydrocyclones in service offer the following advantages: they compare favorably with wet tables for cleaning coal and with flotation cells for cleaning smaller coal; they remove pyritic sulfur simply and easily; they lower plant costs because of compactness of installation and reduction in structural requirements; and they have no moving parts and no recovery of medium is required. Results of a two-stage hydrocyclone are tabulated. Schematic figures are shown for a two-stage unit, a single-stage unit, distribution curves for a two-stage hydrocyclone, and for comparative performance of a hydrocyclone with a washing table.

1963

35087 **APTIC NO. 58027**

Andersen, Holger C., Philip L. Romeo, and Duane R. Steele

TREATMENT OF GASES. *(Engelhard Industries, Inc., Newark, N. J.) U. S. Pat. 3,084,023. 3p., April 2, 1963. 3 refs. (Appl. March 11, 1960, 2 claims).*

In this process for preferential removal of impurities (acetylene, nitrogen oxides, and carbonyl sulfide) from a fuel gas of hydrogen and carbon monoxide, the gas contacts a supported catalyst containing palladium and ruthenium at 0.001 to 2.0% by weight. Nickel catalyst may be used if lower cost is necessary. The reaction temperature is 100-250 C, and any oxygen present should be less than the stoichiometric quantity required for oxidation of carbon monoxide to carbon dioxide. The impurities are hydrogenated and released as effluents. This can be used to purify coke oven gas.

1962

35088 **APTIC NO. 58064**

Brennan, James A.

REMOVAL OF NITROGEN OXIDES FROM COMBUSTION GASES. *(Socony Mobil Oil Co.) U. S. Pat. 3,015,369. 5p., Jan. 2, 1962. 3 refs. (Appl. May 23, 1960, 5 claims).*

A method of removing nitrogen oxides from combustion gases is discussed. The method comprises contacting the gas with crystalline alkali or alkaline earth metal aluminosilicates at 400 to 600 C. The aluminosilicates are rigid three-dimensional networks made up of unit cells. The unit cells dimensions should not change with dehydration or rehydration. This material is subjected to thermal pretreatment before contact with the gas at a temperature of 400 to 550 C. This process can reduce smog formation by removing the nitrogen oxides from the exhaust gases of internal combustion engines. The aluminosilicates is a synthetic zeolite molecular sieve.

1961

35089 **APTIC NO. 57864**

Andersen, Holger C., William J. Green, and Duane R. Steele

CATALYTIC TREATMENT OF NITRIC ACID PLANT TAIL GAS. *Ind. Eng. Chem., 53(3):199-204, March 1961. 16 refs.*

The catalytic treatment of nitric acid tail gas is discussed. Catalytic treatment of the gas stream with a reducing substance can reduce all the oxygen-containing compounds in the stream except water. The experimental apparatus used is described. Nitrogen and air were first metered at the desired flow rates; nitric oxide was added; and the mixture was brought to desired temperature. When catalyst temperature and flows were steady, fuel was introduced. Under conditions of ignition, the catalyst temperature rose rapidly to a new steady value. At this time, gas samples were taken for analysis. A palladium catalyst was favorable for hydrocarbon fuels, and a platinum catalyst was favorable with ammonia fuels. Total purification can be achieved with fuel deficiency when nitrogen dioxide is converted to NO. Results of experiments are given in tables and discussed. The use of catalytic treatment for heat generation is described.

35090 **APTIC NO. 58065**

Andersen, Holger C. and William J. Green

METHOD OF PURIFYING GASES CONTAINING OXYGEN AND OXIDES OF NITROGEN. *(Engelhard Industries, Inc., Newark, N. J.) U. S. Pat. 2,970,034. 3p., Jan. 31, 1961. 8 refs. (Appl. April 5, 1957, 7 claims).*

Fuel gas, consisting of hydrogen, carbon monoxide, or gaseous hydrocarbons, is added to the nitric acid manufacturing tail gas stream in a quantity less than the stoichiometric quantity needed for complete reaction with the oxygen and nitrogen oxides. This gas mixture is then passed through a first stage catalyst bed. The catalyst may be a platinum group metal supported on activated alumina. The effluent gases from the first stage are cooled and more fuel is added. The resulting gas mixture is passed through a second catalyst bed. By use of this process, oxygen can be effectively removed from waste gases, and the nitrogen oxides catalytically reduced to nitrogen.

35091 **APTIC NO. 58026**

Cohn, Johann G. E., Duane R. Steele, and Holger C. Andersen

METHOD OF SELECTIVELY REMOVING OXIDES OF NITROGEN FROM OXYGEN-CONTAINING GASES. *(Engelhard Industries, Inc., Newark, N. J.) U. S. Pat. 2,975,025. 3p., March 14, 1961. 5 refs. (Appl. Nov. 5, 1957, 20 claims).*

A process for selective removal of nitrogen oxides (nitric oxide and nitrogen oxide) from oxygen-containing waste gas produced in the oxidation of ammonia during nitric acid production is described. The waste gases may include 1 to 22% oxygen, 0 to 2% NO, and 0 to 2% NO_2. An admixture of gases and ammonia contacts a platinum group metal-containing catalyst at a temperature of 150-400 C and a space velocity of 300-100,000 standard vols of gas/vol of catalyst/hr. The ammonia must be present in at least stoichiometric quantity required for selective reduction of the nitrogen oxides.

35092 **APTIC NO. 57999**

Minnick, Leonard John

METHOD FOR CONTROLLING SMOG. *(G. and W. H. Corson, Inc., Plymouth Meeting, Pa.) U. S. Pat. 2,991,014. 3p., July 4, 1961. 2 refs. (Appl. Aug. 31, 1960, 4 claims).*

A method is described for controlling smog by dispersing colloidal sized particles of a microcrystalline calcium compound into the atmosphere. The calcium compound has the formula $Ca(OH)_2.nMgO$ in which n equals 0 to 1. The compound has an effective particle size of colloidal dimensions from 0.1 to 10 micron, a neutralization coefficient not exceeding the difference between 13,000 ppm and 3000 ppm times the value of n, and does not react with carbon dioxide to any great extent. The calcium compound as an aerosol is dispersed in the atmosphere from 0.001 to 1.0 ppm. In the atmosphere, dissociated particles yield Ca(+2) and Mg(+2) ions which neutralize the charge on dispersed waste particles in the atmosphere, causing them to coalesce and precipitate out.

1960

35093 **APTIC NO. 58016**

Fletcher, W.

THE TREATMENT OF NITRIC ACID PLANT TAIL GAS. *Brit. Chem. Eng., vol. 5:789-790, Nov. 1960. 5 refs.*

Catalytic reduction of offensive nitrogen dioxide content of tail gas to nitrogen is reviewed. In one process, tail gas is mixed with a quantity of fuel gas slightly greater than stoichiometric requirements. The resulting mixture is burned on a catalyst bed producing large quantities of recoverable heat. Various gases may be used including hydrogen, natural gas, petroleum gases, coke oven gas, and carbon monoxide. Four types of catalysts are employed, ranging from platinum group metals deposited on alumina spheres to nickel copper catalysts. Reactor design must take into consideration space velocity, pressure drops, limiting temperature, and fuel. The economics of the tail gas reduction would depend on the individual factors at the plant; however, the importance of clean air is stressed.

1959

35094 **APTIC NO. 58005**

Childers, Eugene, Charles W. Ellis, and Donald J. Ryan

PROCESS FOR CATALYTICALLY REDUCING NITROGEN OXIDES IN INDUSTRIAL STACK GASES. *(E. I. du pont de Nemours and Co., Wilmington, Del.) U. S. Pat. 2,910,343. 4p., Oct. 27, 1959. 5 refs. (Appl. Dec. 8, 1955, 3 claims).*

A process for removing nitrogen oxide fumes from stack gases by catalytic reduction is described. An excess of reducing gas containing hydrogen and up to 63% natural gas is added to the stack gas. At 540-755 C, the mixture is passed over an alumina-supported platinum catalyst and later over an alumina-supported nickel catalyst at a space velocity of at least 25,000 reciprocal hours. The platinum catalyst is disposed in a bed having a depth less than half the depth of the nickel bed.

35095 **APTIC NO. 58007**

Forward, F. A. and H. Veltman

DIRECT LEACHING ZINC-SULFIDE CONCENTRATES BY SHERRITT GORDON. *J. Metals, 11(12):836-840, Dec. 1959. 18 refs.*

Oxidation in autoclave with sulfuric acid extracted 95 to 99% of the zinc present, produce a quantitative amount of elemental sulfur, and avoid loss of Zn due to ferrite formation. It is possible to extract 99% of the Zn in a 40% Zn concentrate by treating a finely ground sample with a solution containing about 60 gpl Zn and 10 to 12% free H_2SO_4 by agitation in an autoclave at 110 C using an O_2 pressure of 20 psi in a period of 2 to 4 hr. Insoluble oxides are separated from the solution by filtration. The S present in the ZnS can be quantitatively converted to free S and subsequently pelletized or separated by filtration. The direct conversion to free S eliminates the necessity of producing sulfur dioxide or H_2SO_4 in an electrolytic Zn operation. The S can be separated from the pellets or concentrate by hot filtration and the undissolved ZnS returned to the leach. The resulting solution, having a pH of 1.0 to 1.5, and a Zn^{++} content of 120 gpl or higher, should be amendable to purification by conventional methods prior to electrolysis, which would produce cathode Zn and regenerate H_2SO_4 for recycling to a subsequent autoclave leaching operation.

35096 **APTIC NO. 57869**

Krijgsman, C.

THE DUTCH STATE MINES HEAVY MEDIUM CYCLONE WASHING SYSTEM. PART 1. *Mining Congr. J., 45(3):47-52, May 1959.*

A heavy medium cyclone washing system is discussed. This type of system can clean nut size and large coal using magnetite as the heavy medium. More specialized steels and alloys are demanding consistently lower sulfur coals, calling for cleaning requirements impossible to meet with present fine coal washing equipment. Also, coal must be cleaned at lower specific gravities, resulting in efficiency drops; recoverable coal is lost with the refuse. Fine coal can be cleaned with the heavy medium cyclone washer at specific gravity from 1.30 on up and make an extremely sharp separation at any gravity required. Also, this system not only cleans the coal, but will do so with a high degree of efficiency regardless of the specific gravity used; as long as the feed tonnage of the cyclone is not exceeded, wide variations in the amounts of rejects will not affect the cleaning efficiency.

35097 **APTIC NO. 58021**

Massey, O. D.

DEMISTERS FOR SULFURIC ACID PLANT STACKS. *Chem. Eng. Progr., 55(5):114-118, May 1959. (Presented at the Air and Water Pollution Abatement Conference, MCA, Cincinnati, March 1959.)*

Demisters for sulfuric acid plant stacks are discussed. Cyclone-type demisters eliminated large particles (20 micron) but wasted considerable power removing the smaller sizes. Packed beds of various sorts also only had value in certain applications. Glass fibers as a stack gas filtering medium tended to pack when wet, making it difficult to force the gas through. The most practical material found was the knitted wire mesh filter, used in two stages. With operation in the correct velocity range, a layer of the entrained liquid scrubber cleans the gas stream, increases its velocity, and thereby impacts fine particles. Construction materials and gas stream velocity are critical.

1958

35098 **APTIC NO. 58012**

Bienstock D., L. W. Brunn, E. M. Murphy, and H. E. Benson

SULFUR DIOXIDE--ITS CHEMISTRY AND REMOVAL FROM INDUSTRIAL WASTE GASES. *Bureau of Mines, Information Circ., no. 7836:1-96, 1958. 253 refs.*

More progress has been made in removing sulfur dioxide from flue gases by gas washing processes than by other techniques. A major disadvantage common to all wet absorption processes is that the gases cool. The scrubbed gas, which still contains some SO2, may settle in the immediate vicinity of the plant. The use of an adsorption process is conceivable, and fundamental data for adsorption of SO2 on carbon, silica gel, platinum, and metal oxides are presented. Reduction of SO2 with hydrogen, carbon monoxide, and methane occurs at commercially feasible rates. Reduction of SO2 with C in the form of coke and anthracite has also been practiced on a laboratory and plant scale. Sulfur dioxide may be oxidized to sulfur trioxide with air or O2 in the presence of a catalyst, or with ozone, light or electrical discharge. Basic metallic oxides can serve as effective absorbents of SO2 at flue gas temperatures. Sulfates formed in the absorption could be electrolyzed for recovering sulfuric acid and for regenerating metallic oxide. Thermal decomposition of sulfates could also be employed and SO2 or SO3 recovered. Sulfites formed could be thermally decomposed or oxidized with air to the sulfate.

35099 **APTIC NO. 58085**

Lee, G. and W. H. Gauvin

CHEMICAL RECOVERY FROM NEUTRAL SULFITE SEMICHEMICAL SPENT LIQUORS BY THE ATOMIZED SUSPENSION TECHNIQUE. *TAPPI, 41(3):110-116, March 1958. 22 refs. (Presented at the Technical Association of the Pulp and Paper Industry, Alkaline Pulping Conference, 10th, New Orleans, La., Nov. 1956.)*

Neutral sulfite semichemical (NSSC) spent liquors have a high pentose and acetate content and exert a BOD load nearly as high as sanitary sewage. To alleviate stream pollution, and to allow recovery of salable chemicals, an atomized suspension technique of treating this waste is proposed. The liquors are atomized in the absence of air or other foreign gases into the top of a tower, the walls of which are maintained at a high temperature. The finely divided droplets of liquor are entrained down the tower by the water-vapor atmosphere in which they are suspended, and pass through successive zones of evaporation, drying and thermal decomposition. During this treatment, most of the sodium is converted to sodium carbonate. The solids, steam, and uncondensable gases (hydrogen sulfide, carbon dioxide, and fuel gases) are then separated by simple means. An experimental 8-in. diameter by 10-foot reactor gave excellent heat transfer and high rates of reaction operating under a pressure of 30 psi. An industrial process is possible which would be thermally self sufficient and from which sodium carbonate, sulfur, and steam could be recovered. Its total cost in 1958 would be $885,000 and the annual return is estimated at $366,500.

1957

35100 **APTIC NO. 57871**

Kakabadze, V. M. and I. L. Kakabadze

ABSORPTION OF NITROGEN(II) OXIDE GAS BY THE DRY METHOD WITH SIMULTANEOUS PRODUCTION OF FERTILIZER. *(Pogloshcheniye nitroznykh gazov sukhim sposobom s odnovremennym polucheniyem slozhnykh udobreniy). Text in Russian. Soobshch. Akad. Nauk Gruz. SSR, 18(5):549-556, 1957. 4 refs.*

A method for removing nitric oxide from industrial exhaust using dolomite, manganese carbonate ore, or manure as a low cost absorbent is described. Data from laboratory tests indicate that this method is practicable and yields valuable complex magnesium, calcium, and manganese nitrate fertilizers in a granulated form.

35101 **APTIC NO. 57976**

Riesz, Charles H., Fred L. Morritz, and Karl D. Franson

CATALYTIC DECOMPOSITION OF NITRIC OXIDE. *Air Pollution Found. (Los Angeles), 2(8):1-22, May 1957. 14 refs.*

Nitric oxide (NO) derived principally from automobile exhausts (2000 ppm) is an important factor in smog formation. The possibilities of catalytic decomposition of nitric oxide emitted from exhaust tail pipes were investigated. Test conditions for the studies were as follows: gas mixture NO-nitrogen, NO concentration 2000 ppm, gas space velocity 2000 vol/vol catalyst-min, and temperature range 300-700 C. Some 21 selected commercial catalysts and 17 laboratory-prepared catalysts were evaluated. Under the stated test conditions, none of the catalysts were evaluated. Under the stated test conditions, none of the catalysts effected significant decomposition of NO. Catalysts tested and the results from each are described. Carbons activated by potassium carbonate were efficient reducing agents (70-85% at 700 C). The exact reactions occurring were not determined. The cost of such catalysts is moderate and, although they are consumed by the reduction reaction, the added cost for reacting with NO only would be 0.5 to 1 cent/gal of the gasoline used in 1957.

1956

35102 **APTIC NO. 57985**

Scharf, H. B. and E. C. Dominguez

THE FLUIDIZED BED REACTOR INSTALLATION AT SPARROWS POINT. *Trans. AIME (Am. Inst. Mining Metallurgical and Petroleum Engr.), vol. 205:517-523, May 1956.*

Total rated annual capacity of the steel plant is 6.2 million ingot tons. The large amount of light-weight end product requires a number of pickling installations that necessarily consume large quantities of sulfuric acid. Total consumption in the plant is near 10,000 tons per month, of which 55 to 60% is required for pickling. Production of H2SO4 was 93,000 tons in 1954. Coking operations at the plant produce a residual fuel gas with a net heating value of 525 to 545 Btu. About 50% of this gas is desulfurized and used in the open hearth furnaces. This operation produces 20 to 22 tons of hydrogen sulfide per day which is adsorbed in a 2% sodium carbonate solution. The reactor installation consists of three fluidized bed reactors. The first two burn a mixture of Canadian pyrites. The third reactor treats carbon monoxide-bearing Lebanon pyrite concentrates. The reactors operate with feed rates of up to 10 tons per day. Overall conversion of sulfur dioxide into H2SO4 obtained by dead roasting pyrites concentrates is 84-90% of the sulfide S.

35103 **APTIC NO. 58896**

Van Berchel, F. W.

EXPERIMENTS ON COMBUSTION EFFICIENCY WITH FUELS OF DIFFERENT ASH CONTENT. VOLATILE MATTER AND FINENESS IN A LARGE PULVERISED FUEL FIRED STEAM GENERATOR EQUIPPED WITH A STORAGE SYSTEM. *Proc. World Power Conf., 5th, Vienna, Austria, 1956, p. 3193-3220. 5 refs.*

A variety of tests were run on the burning of pulverized coals of different ash content, volatile matter, and fineness in a high-pressure, 135 tph boiler with a furnace equipped with multiple dowward-firing burners in the roof. Air added through ports in the furnace roof near the burners and through the sidewalls yielded satisfactory performance with mixtures of coals with as low as 11% volatile matter. The influence of steam addition to primary air and fineness of different fuels were investigated. The effects of different air to coal ratios and of high ash contents were also studied. The total loss in thermal efficiency due to unburned carbon was calculated from the amount of C in the fly dust. Results of the experiments show that: The introduction of tertiary air through the furnace roof and side wall ports and the installation of deflecting plates at the burners and air slots diminish the C loss and stabilize the flame when low volatility coal is used; small grain size is of much more importance for low-volatile than for medium-volatile coal; the addition of steam to the primary air to simulate as much as 9% moisture in the coal does not increase C loss; coal with a high ash content can be burned with excellent efficiency; and variation of the velocity of the air/coal mixture at the burner tips from 13 to 18 m/sec has no noticeable effect.

1955

35104 **APTIC NO. 57854**

Baker, Harold T. and Rhea N. Watts

PREPARATION OF ACTIVATED CARBON. *(Esso Research and Engineering Co., Inc.) U. S. Pat. 2,718,505. 2p., Sept. 20, 1955. 4 refs. (Appl. Sept. 13, 1950, 4 claims).*

The production of activated carbon suitable for gas adsorption in high yields, using mixtures of tars and acid sludges, is described. The sludge and tar are mixed in a ration of 1:1 to 10:1. The acid sludge is usually a thick, non-fluid mass, but when mixed with the tar, it becomes a mobile mass or a fluxed tarry liquid sludge. Distillation at 750 F removes aqueous material and the bulk of volatile matter from the mixture. The distilled mixture is coked in a reactor between 1100 and 2000 F, preferably in an inert atmosphere such as nitrogen or methane. Oil and other remaining volatile matter is removed or destroyed in the operation, and a solid coke product is recovered. The crude coke is activated by heating to 1100 to 1800 F with steam, carbon dioxide, or flue gas until a yield of 50 to 60% by weight of the coke charge is produced. The product is the activated C.

35105 **APTIC NO. 58868**

DeHaas, G. G. and G. A. Hansen

THE ABATEMENT OF KRAFT MILL ODORS BY BURNING. *TAPPI, 38(12): 732-738, Dec. 1955. 15 refs.*

Atmospheric pollution of kraft pulp mills is caused mainly by sulfur compounds, including hydrogen sulfide, methyl mercaptan, dimethyl sulfide, and dimethyl disulfide. When it was decided to use some method other than the lime kiln of the recovery furnace to burn digester blow-gases, an Anthony furnace was selected. With this method foul gases are first mixed with dilution air and then delivered to the secondary chamber of the furnace. Preliminary laboratory studies had shown that all organic sulfides are destroyed at 1200 F. Therefore, a temperature of 1400 F was selected for operating the furnace. A number of determinations of the sulfur dioxide content and the odorous sulfur compounds left in the flue gas from the furnace indicated almost 100% conversion to SO2 when the control temperature was varied between 1100 and 1400 F.

35106 **APTIC NO. 58846**

Jackson, A. and John M. Solbett

SULPHURIC ACID PLANT: TAIL GAS TREATMENT. *Chem. Ind. (London), no. 42:1304-1311, Oct. 15, 1955. 25 refs. (Presented at the Society of Chemical Industry, London, England, April 4-5, 1955.)*

The principal air pollutant in a sulfuric acid plant is unreacted sulfur dioxide. The best way to reduce atmospheric pollution from contact acid plants is to get the highest possible conversion. Wherever high conversion efficiency is not possible, the tail gas can be scrubbed to reduce the acidity of the final atmospheric exhaust. Generally, the scrubber used in a packed tower. Chemical methods have been developed to convert SO2 into salable products. The method most suitable for treating contact plant tail gases is the ammonia scrubbing method in which the final product is ammonium sulfate. Occasionally the exhaust gas from a contact plant absorption tower has a bad appearance. When this is caused by the presence of excessive mist, it is possible to effect a great improvement by installing mist precipitators.

35107 **APTIC NO. 57899**

Peters, M. S. and J. L. Holman

VAPOR- AND LIQUID-PHASE REACTIONS BETWEEN NITROGEN DIOXIDE AND WATER. *Ind. Eng. Chem., 47(12):2536-2539, Dec. 1955. 5 refs.*

Investigations were carried out to determine whether the chemical reaction in nitrogen dioxide absorption by water occurs in the gas-phase or the liquid-phase. Results indicated that both gas-phase and the liquid-phase reaction occurred in the removal of nitrogen dioxide from gases by contact with aqueous solutions. The major part of these reactions did not occur in the bulk phases, but took place in the gas film and liquid film at the boundaries between the two phases. The presence of nitric oxide in the exit gases when sodium hydroxide solution was used as the absorbent indicated the existence of a gas-phase reaction, and the observed increase in gas temperature in the absorption column was consistent with a gas-phase reaction. The occurrence of a liquid-phase reaction was indicated by the fact that the rate of removal of nitrogen oxides from a dilute gaseous mixture was not directly proportional to the partial pressure (or fugacity) of the water vapor at constant conditions of temperature, gas rate, and gas composition. (Author summary modified)

1954

35108 **APTIC NO. 58215**

Allegheny County, Pa. Bureau of Smoke Control

FIFTH ANNUAL REPORT OF ACTIVITIES FOR THE YEAR ENDING MAY 31, 1954. *44p., 1954. 14 refs.*

Pollution control efforts are summarized for the steel and coal industries, railroads, and boats. The 1953-1954 annual report of the steel industry is included and summarizes research program on blast furnaces, open hearths, and bessemer dust abatement. The Final Summary of the Western Pennsylvania Coal Operator s Association Industrial Fellowship is presented. The report summarizes information on spontaneous heating of coal and coal refuse piles, suggestions and recommendations on the construction of refuse piles, and on the control and extinguishment of refuse fires. A description of the colorimeter and the limited number of tests which have been made on coal, pyrite, and marcasite are included.

1952

35109 **APTIC NO. 58043**

Allgood, R. W.

SULPHURIC ACID AND LIQUID SULPHUR DIOXIDE MANUFACTURED FROM SMELTER GASES AT COPPER CLIFF, ONTARIO. *Can. Mining Met. Bull. (Montreal), 45(497):153-155, March 1952. 2 refs. (Presented at the General Meeting, Jan. 1952.)*

Efforts at Copper Cliff have been concentrated on low-cost sulfur recovery methods. The first method of recovery uses sulfur dioxide from smelter gases in sulfuric acid manufacture. The gases are scrubbed with dilute H2SO4 in two towers, go through two Cottrell precipitators, and are dried by scrubbing with 93% H2SO4. The SO2 is converted to sulfur trioxide at temperatures of 300-400 C and passes through a tower where it comes in contact with 99% H2SO4 and is rapidly absorbed. Acid is steadily bled from the system and diluted to 93% for more convenient shipping. A new smelting process which releases gas containing 75% SO2 led to the recovery of liquid SO2. Sulfur dioxide is delivered under pressure through a 16 in. stainless steel flue and cleaned by passing it through glass-wool filters. Sulfur dioxide is dried by scrubbing with 93% H2SO4, compressed, and passed through oil separators, followed by cooling with water in tube-and-shell heat exchangers to condense it. Sulfate pulp mills are the primary users of liquid SO2.

1951

35110 **APTIC NO. 57901**

Johnson, E.

RECOVERY OF PURE SULFUR FROM COAL GAS. *Gas J., 265(4571):108-110, 125, Jan. 10, 1951.*

The development of a fluidization process for extraction of pure sulfur from spent oxide in coke oven gas (coal gas) was investigated. Ideally the process would operate continuously and at the same rate as the purification process. It would yield sulfur of high purity, and the oxide after extraction would retain its reactivity to hydrogen sulfide. The economic value of the process was examined considering the nation as a whole and from the point of view of the gas industry. If high purity sulfur were produced from spent oxide and the price were competitive with that of crude sulfur, the operating cost of the process would be considerably less per ton. Cooling was the better than evaporation for obtaining sulfur product from solution. Benzole was proposed as the best solvent since the process was situated at a gas works. A product containing 95% sulfur could be obtained. A unit tentatively designed to purify foul coal gas by means of the fluidized solids technique was described.

35111 **APTIC NO. 58013**

Najarian, H. K., Karl F. Peterson, and Robert E. Lund

SINTERING PRACTICE AT JOSEPHTOWN SMELTER. *J. Metals, 3(2):116-119, Feb. 1951.*

Primary products of the Josephtown zinc smelter are zinc metal, lead-free zinc oxide pigments, cadmium metal, and sulfuric acid. Sulfur dioxide containing gases from the roasting operations are diverted to a contact acid plant for sulfuric acid manufacture. It is possible to make zinc sinter which is free of contaminants. Lead and cadmium, both being more easily reduced with carbon than zinc, are driven ahead of the hot burning zone in the sinter cake. On the soft sinter machines, the charge is quite refractory and little slagging takes place. The top part of the bed is freer of impurities than the bottom due to condensation of lead and cadmium compounds in the grate area. This process results in eliminating 80% of the lead and 90% of the cadmium sulfur. A dust collector is included in the sintering plant. This takes care of the major part of the dust produced at material transfer points in the sintering residue, and furnace plants. Cottrell precipitators for recovering fumes from the sintering machine gases are also included. Proper conditioning of the gases entering the Cottrells is essential for efficient collection. The absolute humidity of the gases is maintained as high, and the dry bulb temperatures is low, as physical conditions of the collected dust and corrosion limitations permit. Dust collected bby the Cottrells averages about 2% of the calcine and soft sinter fed to the sintering machine.

1948

35112 **APTIC NO. 58225**

Yushok, Wasley and Firman E. Bear

POULTRY MANURE. ITS PRESERVATION, DEODORIZATION, AND DISINFECTION. *New Jersey Agricultural Experiment Station, Rutgers University, New Brunswick, N. J., Bull. 707, 11p., Oct. 1948. 8 refs.*

The preservation, deodorization, and disinfection of poultry manure were investigated. Eighty one percent of the nitrogen, 88% of the phosphoric acid, and 95% of the potash fed to the hen are excreted in the manure. Superphosphate is the most effective agent used in preventing the loss of N2 from poultry manure. Its rate of application should be at least 100 lbs/ton of fresh manure. Manure can be preserved by artificial drying, but this causes a loss of N2 no matter whether the manure has been treated with preservatives or not. Hydrated lime is the most effective deodorizer. It has a marked effect in reducing N2 losses from fresh manure and in improving the handling qualities of the product. It should be applied at a rate of 100-200 lbs/ton of manure. The 100 lbs rate is adequate if the lime is thoroughly mixed with the manure. About 1 1/2 lbs of hydrated lime a day would be adequate for treating the droppings under the roosts of 100 hens. The objectionable odors emanating from a drying machine may be eliminated by mixing hydrated lime with the manure before it is placed in the drier. The use of 100 lbs of hydrated lime/ton of wet manure is recommended. (Author summary modified)

1942

35113 **APTIC NO. 57900**

Johnstone, H. F.

SULFUR DIOXIDE. *Ind. Eng. Chem., 34(8):1017-1028, Sept. 1942. 115 refs.*

Sulfur dioxide is obtained from burner and smelter gases, from coke oven gas, from natural and flue gases, and from sulfite pulp liquor, and from the roasting of sulfates. Sulfur dioxide is produced in concentrated form from burner gases by absorbing the gas in cold water and stripping the solution with steam. Absorption takes place in a series of packed towers in which a counterflow of water and gases is maintained. For recovery of SO2 from dilute gases, an absorbent with a greater capacity than water is desirable, such as solutions of basic aluminum sulfate, arylamines, or ammonium sulfite and bisulfite. The largest single use of liquid SO2 is as a selective solvent in treating light oils and lubricating fractions from petroleum. It can also be used in treating semidrying oils, in the production of synthetic resins, as a solvent for inorganic compounds, or as a refrigerant. Gaseous SO2 can be reduced to elemental sulfur, used in reactions with salt, or for the production of chlorine derivatives. The production of sulfuric acid, SO3, and many inorganic chemicals such as sulfites, thiosulfates, and hydrosulfites, can also be accomplished with SO2.

1941

35114 **APTIC NO. 57839**

American Society of Mechanical Engineers, New York, N. Y.

DUST SEPARATING APPARATUS: POWER TEST CODES. (FINAL REPORT). *PTC 21-1941, 29p., 1941.*

A dust-separating apparatus test code designed by the American Society of Mechanical Engineers is presented for tests on all types of dust-separating apparatus installed for operation in conjunction with solid-fuel-fired furnaces. A code on definitions and values defines certain technical terms and numerical constants which are used throughout the test code, and a section on instruments and methods of measurement describes their application, calibration, sensitivity, and accuracy. A section on computing and reporting results is also included.

1936

35115 **APTIC NO. 57819**

Hollings, H.

THE FORMATION OF NITROGENEOUS GUM DURING THE STORAGE AND DISTRIBUTION OF GAS. *Gas J., vol. 216:459-468, Nov. 1936. 54 refs.*

Coal gas (coke oven gas) containing nitric oxide greater than 0.05 ppm may form nitrogeneous gum. A concentration of suspended gum particles above 20 grains/million cu ft of gas creates problems in the storage and distribution equipment. The gum is formed by a reaction of nitric oxide and hydrocarbons in the gas, and the particles formed have a diameter up to 1.2 micron. A method for control of gum formation is by removal of the nitric oxide. One process utilizes iron oxide purifiers; the first stage is adsorption followed by formation of a complex ferro nitrosyl sulfide. A similar process utilizes an extra pair of purifiers charged with ferrous sulfide shavings. Neither process is economically feasible or has a high percentage of removal. Present feasible methods to prevent gum formation involve a reaction chamber prior to storage or distribution. The nitric oxide and the hydrocarbons in the gas react forming the gum, which settles to the bottom of the chamber, and the clean gas is passed on for storage.

35116 **APTIC NO. 58042**

Shively, W. L. and E. V. Harlow

ELECTRICAL REMOVAL OF GUM-FORMING CONSTITUENTS FROM MANUFACTURED GAS. *Trans. Electrochem. Soc., vol. 69:495-517, 1936. 11 refs. (Presented at the General Meeting, 69th, Cincinnati, Ohio, April 25, 1936.)*

A minute quantity of a resinous or gummy suspensoid, formed when nitric oxide combines with oxygen and unsaturated organic compounds is present in manufactured fuel gas. This suspensoid causes distribution difficulties due to its tendency to collect in the minute openings controlling the flow of gas to pilots and burners of automatic appliances. Preliminary trials of a variety of methods for stabilizing gas against gum formation indicated the effectiveness of treating gas with an electrical brush discharge. A special type of apparatus was devised for this purpose. It permits passage of appreciable amounts of electrical current in the form of a brush discharge through large volumes of gas. No dielectric other than the gas itself is required. The high, local electrical stress required for the production of the brush discharge is secured by the use of sharp discharge points. Methods of obtaining the requisite stability of the discharge are described in detail. A commercial-scale electric treater has a capacity rating of 24,000,000 cu ft (680,000 cu m). Average nitric oxide-removal efficiency is approximately 98%, and the total cost of the process is 0.1444 cents/thousand cu ft of gas treated.

1933

35117 **APTIC NO. 58040**

(Inventor not given.)

IMPROVEMENTS IN OR RELATING TO CATALYTIC AND LIKE CONTACT MASSES CONTAINING PLATINUM. *(The Silica Gel Corp., Baltimore, Md.) Brit. Pat. 396,712. 7p., Aug. 8, 1933. (Appl. Feb. 6, 1932, 7 claims).*

Oxidation processes using platinum contact masses for converting sulfur dioxide to sulfur trioxide are described, and a specific type of platinum catalyst is proposed. The catalyst consists of a carrier of a dried hydrous oxide gel (e.g., silica gel) or a base-exchange compound. Platinum is impregnated into the carrier, which contains a promotor made of a metal compound or a mixture of metal compounds. Of these metals, manganese compounds are preferred. The quantity of promotor substance is variable and dependent on the compound or compounds present. Methods of catalyst preparation are reviewed and examples are given.

1917

35118 **APTIC NO. 57835**

Wells, A. E.

AN INVESTIGATION OF THE WET THIOGEN PROCESS. *J. Ind. Eng. Chem., 9(9):872-873, 1917. 1 ref.*

The wet thiogen process for the removal of sulfur dioxide from smelter smoke and the recovery of sulfur was experimentally evaluated. The process, which may take place in water or mother liquor, consists the addition of barium sulfide + SO2 to finally produce sulfur and barium thiosulfate. The ease and efficiency with which the settling decantation and filtering operations take place depend largely on the conditions under which the precipitation is carried out.

MEASUREMENT METHODS

1974

35119 **APTIC NO. 58189**

Bigg, E. K., A. Ono, and Judith A. Williams

CHEMICAL TESTS FOR INDIVIDUAL SUBMICRON AEROSOL PARTICLES. *Atmos. Environ., 8(1):1-13, Jan. 1974. 17 refs.*

A thin film vapor method for the detection of aerosol particles of masses down to 10 to the minus 16 g or less is described. Particles are captured on electron microscope screens precoated by vacuum evaporation with a thin film of reagent, and the reaction proceeds by exposure to the vapor of a suitable solvent. The reaction products are then examined with an electron microscope and compared with similar particles captured on a non-reactive surface such as carbon. The method is capable of detecting a radical such as sulfate in a particle of very small size and allows for a large spreading of the original particle, thus making possible the use of an electron microscope at low magnifications for examination of a large area at one time. Examples are provided for the detection of sulfuric acid, sulfates, nitrates, halides, and persulfates in laboratory, urban, and stratospheric aerosols. (Author abstract modified)

35120 **APTIC NO. 58186**

Black, Francis M. and John E. Sigsby

CHEMILUMINESCENT METHOD FOR NO AND NOX (NO PLUS NO2) ANALYSIS. *Environ. Sci. Technol., 8(2):149-152, Feb. 1974. 14 refs.*

An instrumental chemiluminescent method which utilizes gas phase thermal decomposition of ozone to yield atomic oxygen has been developed to permit rapid, sensitive measurement of nitric oxide and oxides of nitrogen (NO plus nitrogen dioxide). Oxides of nitrogen are measured by photoelectric amplification of a signal produced by the chemiluminescent reaction of NOx and atomic oxygen. The instrument can also be operated in the ozone chemiluminescent mode by flowing the ozone directly to the chemiluminescent reactor and following procedures for NO/O3 chemiluminescence if NO analysis is desired. Attention must be given to response linearity when the method is employed for NOx analysis of real samples. System stability has proven excellent, while signal-to-noise ratio has been found to dictate a 1 ppb detection limit. The method should have feasibility with ambient samples and samples taken from mobile sources with emission control.

35121 **APTIC NO. 58158**

Craig, N. L., A. B. Harker, and T. Novakov

DETERMINATION OF THE CHEMICAL STATES OF SULFUR IN AMBIENT POLLUTION AEROSOLS BY X-RAY PHOTOELECTRON SPECTROSCOPY. *Atmos. Environ., 8(1):15-21, Jan. 1974. 8 refs.*

X-ray photoelectron spectroscopy is an effective way to determine the chemical states of sulfur present in ambient particulate matter. Seven separate chemical species of sulfur were found in polluted atmospheric aerosol samples taken in the Los Angeles and San Francisco areas and consisted of sulfur trioxide, sulfate, sulfur dioxide, sulfites, elemental sulfur, and two kinds of sulfides in terms of net sulfur charge. Sulfates were the dominant species, although reduced forms of sulfur were at times comparable to the sulfate concentrations. The method provides a practical way to account separately for sulfates and nonsulfates. (Author abstract modified)

35122 **APTIC NO. 58115**

Crocker, B. B.

MONITORING PLANT AIR POLLUTION. *Chem. Eng. Progr., 70(1):41-49, Jan. 1974. 17 refs.*

Measuring methods, instrumentation, costs, and applications are outlined for industrial process, effluent, and area monitoring of gases and particulates. Illustrations are provided for a sampling system with a remote monitor, a 24-hour daily composite gas sampling system, a typical sequential sampler, a dilution scheme for continuous stack gas sampling, a Barringer in-stack sulfur dioxide monitor, a Faristor and electronic indicator, a Bailey stack opacity meter, a Lear Siegler opacity monitor, a particulate mass monitor using beta-ray attenuation, and a Lear Siegler beta-ray attenuation particulate monitor with traversing sample probe. Typical ambient air concentration continuous monitors which can be used for stack effluent analysis with dilution are listed for: sulfur dioxide, total sulfur oxides, hydrogen sulfide, oxides of nitrogen, carbon monoxide, oxidants such as ozone, and hydrocarbons such as methane.

35123 **APTIC NO. 58175**

Cunningham, Paul T., Stanley A. Johnson, and Ralph T. Yang

VARIATIONS IN CHEMISTRY OF AIRBORNE PARTICULATE MATERIAL WITH PARTICLE SIZE AND TIME. *Environ. Sci. Technol., 8(2):131-135, Feb. 1974. 27 refs.*

Samples of airborne particulate material were classified with respect to particle size and time during their collection by inertial impaction, and infrared spectroscopic analysis was used to measure the major chemical constituents of the samples. Data obtained clearly indicated that the particulate material collected contained ammonium sulfate, ammonium halide, carbonate, silicate, silica, nitrate, hydrocarbon, and chemisorbed nitrogen dioxide (surface nitrate). The results also showed variations in the chemistry of airborne particulates as a function of particle size and time and supported recent theories on the origin of particulates that have been based on size distribution measurements and may be important in assessing the potential health hazard of particulates as well as the appropriateness of control techniques. (Author abstract modified)

35124 **APTIC NO. 58102**

Dana, V. and J. C. Fontanella

STUDY OF THE NITROGEN DIOXIDE ABSORPTION IN THE 6.18 MICRON REGION (Etude de l absorption du dioxyde D azote dans la region de 6.18 micron). Text in French. Nouv. Rev. Opt. Appl., 4(4):237-241, 1974. 8 refs.

The titration of atmospheric minor constituents is at present performed by methods involving infrared absorption spectrometry. Such experiments were recently performed from aircraft and balloon. They aim at establishing the vertical precise distribution profiles of the nitrogen oxides. The analysis of these atmospheric spectra requires prior laboratory studies. Here a study of the rotational structure of the v sub 3 band of nitrogen dioxide is presented. The published spectrum extends from 1588 cm to the minus one power to 1639 cm to the minus one power. It was recorded on a ONERA dual-grille spectrometer with a resolution of 0.06 cm to the minus one power; the signal/noise ratio is about 50. The wave numbers of the absorption lines are calculated by interpolation between the emission lines of a spectral neon lamp. The interpolation is performed by means of fringes which are generated by an interferometric goniometer. These fringes depend on the rotation of the grating. The analysis of the rotational structure of the band compares the measured wave numbers to the calculated ones. (Author summary)

35125 **APTIC NO. 58153**

Kikuchi, T. T.

MAGNETIC FIELD-MODULATED, ULTRAVIOLET-RESONANCE ABSORPTION NO ANALYZER. *Appl. Opt., 13(2):239-240, Feb. 1974. 3 refs.*

The principle of operation and component elements of a nitric oxide analyzer are described. When ac and dc magnetic fields are simultaneously applied to a gaseous discharge source, the source radiation is modified. The dc Zeeman field splits the radiation symmetrically with respect to the center wavelength. With the application of an ac field, the splittings are modulated around a bias wavelength determined by the dc magnetic field. When this radiation is passed through the medium containing NO, the absorbing NO acts as a discriminator and the frequency modulated source radiation is then converted to amplitude modulation. With no NO present, the amplitude modulated signal is absent. The main elements of the device consist of a magnetic field modulated line source, absorption cell, and a detection system. The line source is chosen to be in resonance with one of the strongly absorbing lines of the species being monitored. The magnitude of the intensity modulated transmitted radiation arising from the NO in the absorption cell then gives a measure of NO gas concentration. The technique should be applicable for all paramagnetic species for which strong resonant sources are available.

35126 **APTIC NO. 58196**

Parsa, Bahman and Samuel S. Markowitz

DETERMINATION OF LEAD IN ATMOSPHERIC AIR AND IN ALUMINUM BY HELIUM-3-INDUCED NUCLEAR REACTIONS. *Anal. Chem., 46(2):186-189, Feb. 1974. 26 refs.*

Helium-3 activation analysis has been applied as a very sensitive means for the determination of trace amounts of lead in atmospheric air. The procedure involves the bombardment of samples with 3He particles to induce the conversion of Pb to 207polonium. The 992 keV gamma-ray of 5.84 hr 207Po is employed as the signal for Pb determination, with only milligram amounts of sample being required. Destructive analysis may be carried out if necessary, and a radiochemical separation procedure to plate Po onto a silver foil is also possible. Accuracy of measurement is about 3-5% for comparative analyses, and error is 9-12% for absolute determinations. The detection limit is approximately 30 pg/sq cm, corresponding to 0.5 ppb in a matrix 100 mg/sq cm thick, under reasonable irradiation and counting conditions. (Author abstract modified)

38127 **APTIC NO. 58367**

Ranweiler, Lynn E. and Jarvis L. Moyers

ATOMIC ABSORPTION PROCEDURE FOR ANALYSES OF METALS IN ATMOSPHERIC PARTICULATE MATTER. *Environ. Sci. Technol., 8(2):152-156, Feb. 1974. 14 refs.*

A procedure has been developed for the multielement analysis of atmospheric particulate matter by atomic absorption spectrometry. Atmospheric particulate samples were collected on polystyrene filters using hi-vol samplers. The filters were dry ashed at 400-425 C, and the residue was dissolved with a mixture of hydrogen fluoride, hydrogen chloride, and nitric acid in Teflon acid digestion bombs. It was possible to quantitatively measure 22 metals in the particulate matter with the appropriate dilutions and matrix corrections. Elements measured by the procedure were: silicon, aluminum, calcium, iron, potassium, sodium, magnesium, lead, copper, titanium, zinc, strontium, nickel, vanadium, manganese, chromium, rubidium, lithium, bismuth, cobalt, cesium, and beryllium. Recovery data for the ashing and dissolution of synthetic samples added to the filter material and presented, as well as data for atmospheric concentrations of elements in particulate samples analyzed by the procedure. (Author abstract modified)

38128 **APTIC NO. 58131**

Raymond, Alain and Georges Guiochon

GAS CHROMATOGRAPHIC ANALYSIS OF C8-C18 HYDROCARBONS IN PARIS AIR. *Environ. Sci. Technol., 8(2):143-148, Feb. 1974. 14 refs.*

Gas chromatographic analysis of C8-C18 organic pollutants of Paris atmosphere were made during fall 1972 using a sampling procedure which involved trapping the vapor over graphitized carbon black followed by heat desorption for direct injection of the pollutants on long, efficient, capillary columns. Separations were made over capillary columns in temperature programming. More than 70 peaks, mostly aromatics and paraffinic hydrocarbons, were identified using a mass spectrometer-computer system coupled to the capillary column. The method allowed for injection of the entire sample into the capillary column without splitting due to the lack of solvent for recovering the pollutants, and sensitivity was found increased by a factor of 100-1000. The procedure avoided severe damages to the column which occur when large amounts of solvent are concentrated in small portions of the column. (Author abstract modified)

38129 **APTIC NO. 58161**

Tschudi, T., G. Herziger, and A. Engel

PARTICLE SIZE ANALYSIS USING COMPUTER-SYNTHESIZED HOLOGRAMS. *Appl. Opt., 13(2):245-248, Feb. 1974. 4 refs.*

A holographic correlation method that permits the determination of the diameter and size distributions of suspended particles with diameters fro 1 to 10 micron by a real-time measurement is investigated. The method uses synthetic holograms calculated from Mie scattering theory, which describes the amplitude and phase of the scattered light from spherical particles suspended in a homogeneous medium as a function of scattering angle, refractive index, particle diameter, and wavelength of the incident light. Measurements of the Mie scattered field of single particles and their comparison with computer calculated theoretical intensity functions indicate that it is possible to determine the diameter of spherical particles in the range of 1-20 micron with an average accuracy of less than or equal to 10%.

1973

38130 **APTIC NO. 58149**

Bakhanova, R. A. and L. V. Ivanchenko

THE CALIBRATION CURVE OF PHOTOELECTRIC COUNTERS AND COMPUTATION OF PARTICLE SIZE DISTRIBUTION WHEN THE RELATIONSHIP BETWEEN PARTICLE SIZE AND ELECTRICAL PULSE AMPLITUDE IS AMBIGUOUS. *J. Aerosol Sci., 4(6):485-498, Nov. 1973. 5 refs.*

In accordance with Mie's theory, the angular distribution of light scattered by a particle is a complex function of particle size and refractive index so that the calibration curve of a photoelectric counter, that is the dependence of the amplitude of electrical pulse on the particle size, has a complex shape which is associated with the optical arrangements and the refractive index of the particle. Use of a white source smooths the curves of light flux against particle size, but does not remove large oscillations. Because there are not enough experimental data on their calibration over a wide range of particle size, calibration curves are presented of a photoelectric aerosol particle counter using forward scattered light in the range of 2.2-18.2 degrees. A range of ambiguity in the relationship between pulse amplitude and particle size can be seen in these curves and a method is proposed for the calculation of particle size distribution within this range.

38131 **APTIC NO. 58074**

Barnes, H. M., Jr., W. F. Herget, and R. Rollins

REMOTE SENSING OF SO2 IN POWER PLANT PLUMES USING ULTRAVIOLET ABSORPTION AND INFRARED EMISSION SPECTROSCOPY. *Preprint, National Environmental Research Center, Research Triangle Park, N. C., Chemistry and Physics Lab., 32p., 1973 (?). 3 refs.*

Two remote sensing instruments, one a commercially available design based on dispersive correlation spectroscopy and the other a research instrument utilizing conventional dispersive grating techniques, were evaluated for the remote sensing of sulfur dioxide in the plume of a coal-fired power plant. The former instrument, in its present design, was found to be inadequate for Environmental Protection Agency use in routine monitoring. The main limitation was inadequate compensation for scattering effects by particulates both in the plume and in the intervening atmosphere. The second method resulted in an SO2 band at 4 micron which, though weak compared to 7.35 and 8.7 micron bands, suffered from no molecular atmospheric interference. Temporal fluctuations were only a few percent of the signal level except during high wind conditions. Examination of dirty plume indicated that it was partially transparent in the infrared, suggesting that infrared could be used to measure gas concentrations in a stack whose particulate concentration is too high to allow ultraviolet measurements. Generally, dispersive spectroscopic techniques were found to give reasonable accuracy for remote concentration measurements under the idealized conditions where atmospheric interference was minimized and the plume temperature was known.

35132 APTIC NO. [illegible]

Blander, M., P. E. Cunningham, H. M. Feder, V. A. Maroni, H. C. [illegible], E. Veleckis, R. C. Vogel, and L. Burris

CHEMISTRY OF AIRBORNE PARTICULATES. *In: Chemical Engineering Division Physical Inorganic Chemistry Semiannual Report, January-June 1973. Argonne National Lab., Argonne, Ill., Chemical Engineering Div., p. 40-47, Oct. 1973. 10 refs.*

NTIS: ANL-8023, Chemistry

Sampling and analytical techniques for particulates were developed to provide data on particulate chemistry as a function of time and size. Very significant differences were found in the chemistry of particles as a function of size and time, which should be considered in formulating theories on particle formation and in assessing the potential health hazard of airborne particulates. A Lundgren-type inertial impactor was used in our experiments to collect airborne particulates. The various impactor stages collect different sized particles. The variation in the concentration of submicron particles with time is considerably greater than that for larger particles, as measured by optical density. Particulates collected by the impactor were analyzed for chemical composition by x-ray fluorescence and an ion microprobe mass analyzer. X-ray fluorescence could be used to establish iron, zinc, lead, and bromine as internal standards in the particulate samples. Concentrations of lead and bromine decreased with increasing particle size and the reverse was true for iron and zinc. A modified infrared spectroscopic technique was developed which reduced the index of refraction by embedding the particles in a suitable material. The infrared spectra were used to determine ammonium, carbonate, silicate, sulfate, nitrate, nitrite, and other ions. The variations of temperature, wind direction, humidity, total weight collected, particle size, and ammonium and sulfate ions with time are mentioned.

35133 APTIC NO. 57845

Bonner, N. A., F. Bazan, and D. C. Camp

ELEMENTAL ANALYSIS OF AIR FILTER SAMPLES USING X-RAY FLUORESCENCE. *California Univ., Livermore, Calif., Lawrence Radiation Lab., Atomic Energy Commission Contract W-7405-Eng-48, TID-4500, UC4, UCRL-51388, 52p., June 1973. 3 refs.*

NTIS: UCRL-51388

An x-ray fluorescence system for elemental analyses of air filter samples was designed. It consists of radioisotope exciters, a silicon (lithium) detector, and a computer-based pulse height analyzer. It is capable of making qualitative measurements of all elements heavier than phosphorus (Z equals 15) and quantitative measurements of all elements heavier than potassium (Z equals 19). For samples on Whatman 41 filter paper and fluoresced for 1000 sec, the three sigma detection limits range from 10 to 100 ng/sq cm. These correspond to 3 to 30 ng/cu m of air for typical 24-hour collections with hi-vol samplers. Accuracy of the system is within + or 10% and reproducibility is better than 5%. The method requires no sample preparation and is completely nondestructive. Quantitative information obtained with such a system can be useful in monitoring trace element concentrations in air, hence in providing data for the formulation and enforcement of air quality standards. (Author abstract modified)

35134 APTIC NO. 57929

Busch, D. E. and J. D. Pennirock

INSTRUMENT TO MONITOR CH4, CO, AND CO2 IN AUTO EXHAUST (FINAL REPORT). *Philco-Ford Corp., Newport Beach, Calif., Aeronutronic Div., Environmental Protection Agency Contract 68-02-0587, Program Element 1AA010, Rept. EPA-650-2-73-030, 40p., Oct. 1973.*

NTIS: PB 226438/AS

An infrared analyzer employing gas cell correlation techniques and thermo-electrically cooled photodetectors has been designed and constructed to measure the concentrations of methane, carbon monoxide, and carbon dioxide in automotive exhaust. The dynamic range from the minimum detectable concentration to the maximum concentration that can be measured accurately for each gas is: methane, 0.5 ppm to 10,000 ppm; carbon monoxide, 0.5 ppm to 10,000 ppm; and carbon dioxide, 10 ppm to 250 ppm. The wide dynamic range is made possible by employing two different sample cell lengths for each gas. The concentrations of the three gases are measured simultaneously and independently. Discrimination against other gases in the automotive exhaust is very good. (Author abstract)

35135 APTIC NO. 49425

Carlson, Gary D. and Wayne R. Black

RAPID METHOD FOR ESTIMATION OF MEANS SULFUR DIOXIDE POLLUTION USING LEAD CANDLES AND ATOMIC ABSORPTION SPECTROPHOTOMETRY. *Environ. Sci. Technol., 7(11):1040-1042, Nov. 1973. 6 refs. (Presented at the American Chemical Society, Midwest Regional Meeting, 8th, Nov. 8-10, 1972.)*

An atomic absorption spectrophotometric method is described for the rapid analysis of lead dioxide candles exposed to ambient air containing sulfur pollutants. The sulfur-bearing material is stripped from the candle, and lead sulfate is dissolved by stirring in a 30% ammonium acetate solution. The slurry is allowed to settle for a short period of time, and a small portion is centrifuged to remove any PbO2 particles. The clear supernatant is then analyzed for lead by atomic absorption. Results were compared with the gravimetric method on duplicate field candles to illustrate the close agreement between the methods. Nitrogen dioxide and nitric oxide gases do not interfere when present in concentrations of ppm or less. Only 7 hr are required for the analyses of 25 candles. This method should be readily applicable to other types of PbO2 samplers, such as sulfation plates. (Author abstract)

35136 APTIC NO. 58119

Cota, Harold M.

PROBLEMS OF MEASUREMENT IN THE ENVIRONMENTAL FIELD. *J. Appl. Meas., 1(1):4-10, July/Aug. 1973. 23 refs. (Presented at the Measurement Science Conference, 2nd, California Polytechnic State Univ., San Luis Obispo, Dec. 1-2, 1972.)*

A review of the status of environmental measuring techniques for air and water quality and noise is presented. Ambient monitoring methods are listed for such pollutants as nitrogen dioxide, nitric oxide, sulfur dioxide, ozone, carbon monoxide, and hydrocarbons; and the status of instrument development is outlined for gases and particulates. A list is also compiled of ambient pollutants currently being monitored by the Environmental Protection Agency. Measurement approaches are illustrated for both mobile and stationary sources. Appendices list national ambient air quality standards and significant harm levels for various pollutants and standards for performance of new power plants and incinerators and for new vehicles.

35137 APTIC NO. 58070

Davis, John W.

APPLICATION OF A BETA GAUGE TO THE MEASUREMENT OF MASS EMISSIONS IN A COAL FIRED POWER PLANT. *Preprint, Environmental Protection Agency, Research Triangle Park, N. C., National Environmental Research Center, 22p., 1973 (?). 9 refs.*

A series of field tests concerning the mass effluent monitoring of particulate matter from a coal-fired power plant were conducted in which mass determinations obtained by the beta attenuation method were compared with manual sampling results. Beta gauge results were compared with the filter of a manual sampling train and with the front half of the catch. An excellent correlation between the beta attenuation method and the gravimetric method indicated that the beta absorption technique can be an effective way to measure particle concentration. The major problem encountered with the system was loss in the lines between the stack and the measuring device. Further tests are required to determine the severity of this problem. (Author summary modified)

35138 **APTIC NO. 55938**

Gol dshteyn, M. A. and S. Ya. Zvanskiy

A UNIVERSAL OLFACTOMETER. *(Universal nyy ol faktometer). Text in Russian. Gigiena Truda i Prof. Zabolevaniya, no. 8:50-52, 1973. 5 refs.*

A portable, universal olfactometer for the examination of the sense of smell in subjects exposed occupationally to polluted air is described. An air jet of adjustable duration containing a malodorous substance is placed in a chamber of the instrument which is inserted into the nose of the person being tested. The acuity of smell is determined from the time necessary for the person being tested to recognize and identify the odorous substance.

35139 **APTIC NO. 58076**

Golden, Catherine and Eugene Sawicki

ULTRASONIC EXTRACTION OF TOTAL PARTICULATE AROMATIC HYDROCARBONS (TPAH) FROM AIRBORNE PARTICLES AT ROOM TEMPERATURE. *Preprint, American Chemical Society, Washington, D. C., 28p., 1973. 7 refs. (Presented at the American Chemical Society National Meeting, 165th, Dallas, Tex., April 9, 1973.)*

A superior enrichment procedure for the extraction of total particulate aromatic hydrocarbons from airborne particles collected on glass fiber filter paper has been developed. The sample is suspended in a solvent and subjected to ultrasonic waves at room temperature with glass powder to adsorb polar coextractives. The TpAH in the filtered extracts are separated from other compounds by high speed liquid chromatography. Sensitivity is in the nanogram range, and the procedure is highly reproducible. Significantly larger amounts of TpAH are recovered than with Soxhlet extraction (6-8 hr), and the percentage of pAH in the extracts is much higher. The entire procedure requires approximately 40 min, most of which is waiting time. (Author abstract modified)

35140 **APTIC NO. 55635**

Guenther, Rainer

AN OPTICAL SMOKE DENSITY METER FOR DIRECT INDICATION OF THE PARTICULATE QUANTITY PER CUBIC METER FLUE GAS. *(Ein optischer Rauchdichtemesser zur direkten Anzeige der Feststoffmenge pro Kubikmeter Rauchgas). Text in German. Staub, Reinhaltung Luft, 33(9):352-358, Sept. 1973. 9 refs.*

The possibility of constructing an optical smoke density meter to indicate smoke density as the volume of solid substance per volume of flue gas is described theoretically. It would be possible to evaluate the whole cross-sectional area of all particles in the measuring beam by measuring the extinction in the usual way. It would also be possible to determine the center of the particle size distribution by measuring the distribution of the angles of the scattered light. The smoke density can be calculated from the cross-sectional area and from the average particle radius associated with the center of particle size distribution.

35141 **APTIC NO. 58251**

Hare, Charles T. and Karl J. Springer

EXHAUST EMISSIONS FROM UNCONTROLLED VEHICLES AND RELATED EQUIPMENT USING INTERNAL COMBUSTION ENGINES, PART 3: MOTORCYCLES. *Southwest Research Inst., San Antonio, Tex., Environmental Protection Agency Contract EHS-70-108, 173p., March 1973. 24 refs.*

NTIS: PB-224844/7AS

Exhaust emissions from seven motorcycles were measured using three separate procedures for each bike. The exhaust constituents measured for the Federal 7-mode tests included hydrocarbons, carbon monoxide, carbon dioxide, and nitric oxide, all by non-dispersive infrared spectrometry. The Federal LA-4 bag sampling procedure measured HC by flame ionization detection, CO and CO2 by NDIR, and NO and nitrogen oxides by chemiluminescence. The exhaust products measured during the steady-state tests included total HC by FIA, light HC by gas chromatograph, HC, CI, CO2, and NO by NDIR, NO and NOx by chemiluminescence, O2 by electrochemical analysis, total aliphatic aldehydes and formaldehyde by the MBTH and chromotropic acid methods, particulates by experimental dilution type sampling device, and exhaust smoke using a PHS full-flow smokemeter. (Author abstract modified)

35142 **APTIC NO. 58108**

Heindryckx, R. and R. Dams

STATISTICAL EVALUATION OF TWO AIR SAMPLERS AND OF THE ACTIVATION ANALYSIS OF AEROSOLS. *Bull. Soc. Chim. Belges (Brussels), 82(9-10):611-615, 1973. 8 refs.*

Using two types of high-volume air sampling systems, the reproducibility of the sampling procedure, the homogeneity of the collected aerosols over the filter, and the standard deviation of the analyses were evaluated. Aerosols were collected simultaneously with four identical samplers at one location. The four filters were quartered, and the concentrations of 11 elements were determined in triplicate on all 16 quarters by instrumental neutron activation analysis. A variance and a propagation of error analysis were performed. For the well-detected elements, the fractionation of samples taken with the Unico pumps increased the overall error of the results. The variation coefficient due to this fractionation was generally larger than that due to the analysis. The sampling with these instruments contributed significantly to the uncertainty on the results. Its variation coefficient was of the same order of magnitude as that due to the fractionation. This was due to difficulties involved in reading the flow rate and computing the total volume of air for the Unico samplers. This contribution increased the variation coefficient for the total procedure for the elements sodium, aluminum, chlorine, vanadium, manganese, and bromine to approximately 9%. When using Becker pumps and flow readings with a sufficiently accurate rotameter, the sampling procedure added only a minor contribution. This could be calculated for only three elements. The total variance of the results obtained with the Becker sampler was between 4 and 9% for the elements with good counting statistics. This was slightly superior to the other sampling system and was largely sufficient for most applications. (Author conclusions modified)

35143 **APTIC NO. 57794**

Houser, Edwin A.

TECHNIQUE FOR MEASURING STACK EMISSIONS. *Power, 117(4):30-31, April 1973.*

Systems for analysis of sulfur dioxide and nitric oxide in power plant stack gases and techniques for eliminating interference from other components are reviewed. Both SO2 and NO can be measured by nondispersive infrared analyzers sensitized to be specific for each compound. Carbon dioxide and water vapor, however, have absorption bands which overlap those of SO2 and NO; and interference must be eliminated by one of the following methods: removal of the interfering gases from the sample before analysis, elimination of the overlapping spectral bands by optical filters, or reduction of the interfering gas to a low constant level so that the interference is negligible or can be calibrated out. Interference from CO2 can be eliminated by an optical filter; since such a filter is unavailable for the SO2 analyzer, interference is eliminated by a filter cell charged with CO2. The best solution for removing water vapor interference is to reduce the vapor to a low, constant level by passing the sample through a refrigerated chiller controlled at 35 F. The sampling system must also remove solid and liquid contaminants, such as fly ash, soot, and acid mists; dry filtration has proven much more effective for cleaning samples than passing both liquids and vapor through a filter medium. Consideration should also be given to selection and location of the pump for forcing the sample from the flue through the sampling system and the refrigerated condenser which reduces sample dewpoint and eliminates condensed water and acid.

35144 **APTIC NO. 57890**

Hurn, R. W.

INSTRUMENTATION AND TECHNIQUES FOR MEASURING EMISSIONS. *In: Engine Emissions. Pollutant Formation and Measurement. George S. Springer and Donald J. Patterson, New York, Plenum Press, 1973, Chapt. 8, p. 291-317. 19 refs.*

The principle, design, instrumentation, calibration, and application of various analytical methods for measuring pollutants are described. The flame ionization technique (FID) can be used to measure hydrocarbons. Nondispersive infrared (NDIR) spectrometry can be used to measure gases such as carbon dioxide, carbon monoxide, nitric oxide, and hydrocarbons. Chemiluminescence is used to measure oxides of nitrogen by producing nitrogen dioxide from the reaction of nitric oxide with ozone. Nondispersive ultraviolet (NDUV) spectrometry can be used to measure NO2. Aldehydes can be measured by the wet chemical methods of chromotropic acid, MBTH, and colorimetric DNPH. Automotive emissions can be sampled by total sample collection, constant-volume sampling, or variable-rate proportional sampling. Emissions from diesel and turbine engines can be measured by a variety of techniques, such as NDIR for CO and CO2, FID for HC, and wet chemical and instrumental methods for NOx.

35145 **APTIC NO. 57891**

Knuth, E. L.

DIRECT-SAMPLING STUDIES OF COMBUSTION PROCESSES. *In: Engine Emissions. Pollutant Formation and Measurement. George S. Springer and Donald J. Patterson (eds.), New York, Plenum Press, 1973, Chapt. 9, p. 319-363. 103 refs.*

Molecular-beam sampling of combustion processes is reviewed. Efforts are made to identify and use convenient dimensionless parameters to facilitate applications to the system designs and correlations of existing and forthcoming data. The direct molecular-beam sampling is described theoretically. The effects of the boundary layer on results are described. Possible effects of chemical relaxations in the free jet are considered. Other possible sources of composition disturbances are skimmer interference, mass diffusions, and background scattering. Applications and instrumentation for the molecular-beam mass spectrometer are described. The system can be used to measure nitrogen, oxygen, hydrocarbons, water, carbon monoxide, nitric oxide, and carbon dioxide in various combustion systems including reciprocating engines.

35146 **APTIC NO. 58173**

Kobayashi, Takao, Masanori Jyumonji, and Fumio Inaba

REMOTE ANALYSIS OF AIR POLLUTING GASES BY LASAR RADAR METHODS. *(Reza, reda ni yoru taiki osen no enkakuteki bunsekiho). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 8(3):277, Oct. 1973. 9 refs. (Presented at the Japan. Society of Air Pollution, Annual Meeting, 14th, Fukushima, Japan, Nov. 6-8, 1973, Paper 30.)*

The Laman laser radar is sensitive to 200-300 m distance for detecting 1000-10 ppm of sulfur dioxide, carbon, and hydrogen compounds. This method is effective for measurements of fixed sources such as stacks, but needs an improvement in its sensitivity. The fluorescence lidar is presently being developed. The cross section of the fluorescence is presented by a formula. The sensitivity at a distance of 200-300 m is 0.1 ppm/m for SO2 at night, and 10 ppm/m for daytime, 3-300 ppm/m for nitrogen dioxide, and 0.001-0.01 ppm/m for I2. By enlarging the system, the sensitivity of the lidar may be improved by one or two digits. The future project is an adaptation of double wave length laser for eliminating fluorescence interference from aerosol particles and obtaining high accuracy for absolute density.

35147 **APTIC NO. 58183**

Kojima, Hiroshi and Toshio Sekikawa

AN ATTEMPT FOR OBTAINING THE AEROSOL SIZE DISTRIBUTION. *J. Meteorol. Soc. Japan, 51(5):287-293, Oct. 1973. 15 refs.*

A method for measuring the size distribution of atmospheric aerosols having a radius from 5 times 10 to the minus 7 to 5 times 10 to the minus 6 cm was investigated. Ion mobility distribution brought into charge equilibrium with polonium-210 was measured by an ion mobility analyzer and transformed into aerosol size distribution. Application of the method to the measurement of aerosols in the atmosphere indicated that the variation of size distribution was reasonable. Experimental values differed from the Boltzmann and Bricard (1962) theories and experimental values by Nolan, with the differences increasing with decreasing size. Experimental values were, however, rather close to the Bricard (1949) and Fuchs theories. Comparisons of the size distributions obtained via this method and by other sizing methods are required to determine the accuracy of experimental values and to solve problems relating to transference from ion mobility distribution to aerosol size distribution.

35148 **APTIC NO. 58176**

Lech, J. F., D. D. Siemer, and R. Woodriff

THE DETERMINATION OF MERCURY IN AIR SAMPLES BY FLAMELESS ATOMIC ABSORPTION. *Spectrochim. Acta, 28B(11):435-439, 1973. 13 refs.*

A method for the determination of mercury in air by flameless atomic absorption has been developed. Porous graphite cups which ordinarily fail to adsorb mercury vapors from the air are plated on the inner surface with a thin layer of gold. Retention of the mercury from an air sample passed through the cup is quantitative, and the sensitivity of the analytical system is 3 times 10 to the minus 10 g which is equivalent to 0.6 microgram/cu m for a 500 cu cm air sample. Relative standard deviation is 11.2%. The method should also prove useful for other types of flameless devices. (Author abstract modified)

35149 **APTIC NO. 58132**

Lonneman, William

REMOVAL OF HYDROCARBON EXHAUST INTERFERENCE IN ETHYLENE-OZONE CHEMILUMINESCENT INSTRUMENTS. *Environ. Letters, 4(2):117-121, 1973. 2 refs.*

A method for the removal of hydrocarbon exhaust interference in ethylene-ozone chemiluminescent instruments has been developed which employs catalytic oxidation by palladium of C2H4 to carbon dioxide and water at the catalyst temperature of 335 C. Sample air is pulled through the reaction vessel by a pump, and the exhaust is routed through a catalyst column consisting of a 3/8 by 12 in. aluminum tube packed with 1/8 in. pellets of 0.5% palladium on alumina. The catalyst column is inserted inside a 10.5 by 1/8 in. stainless steel column packed with 60-80 mesh, grade 58 silica gel. Ethylene and virtually all other HC in the exhaust of the C2H4-O3 instrument are oxidized, and catalyst durability is excellent with undiminished efficiency of HC combustion after more than 35 days of continuous use.

35150 **APTIC NO. 58219**

MacLeod, Kathryn E. and Robert E. Lee, Jr.

SELECTED TRACE METAL DETERMINATION OF SPOT TAPE SAMPLES BY ANODIC STRIPPING VOLTAMMETRY. *Preprint, National Environmental Research Center, Research Triangle Park, N. C., Quality Assurance and Environmental Monitoring Lab., 14p., 1973 (?). 10 refs.*

Anodic stripping voltammetric analysis was applied to two-hour particulate samples collected with a spot tape sampler as part of a program to determine the contribution of lead, cadmium, and copper in fuels to ambient air levels. The sampled spots were analyzed after ashing at low temperature and extracting with acid. The quantity of metal present in the samples ranged from 7-350 ng of Cd, from 80 ng-2.4 micrograms of Pb, and from 6 ng-1 microgram of Cu. The maxium relative standard deviation for the method was less than 12% for all three metals with the averages of 4.3% for Cd, 5.9% for Pb, and 3.7% for Cu. Analytical sensitivities were sufficient to characterize diurnal variations of these metals in samples collected in Chicago and Washington, D. C. (Author abstract modified)

35151 **APTIC NO. 58125**

Maltoni, G. Giacomelli, C. Melandri, V. Prodi, G. Tarroni, A. De Zaiacomo, G. F. Bompane, and M. Formignani

AN IMPROVED PARALLEL PLATE MOBILITY ANALYZER FOR AEROSOL PARTICLES. *J. Aerosol Sci., 4(6):447-455, Nov. 1973. 11 refs.*

A high resolution, parallel plate mobility analyzer is presented, together with improvements to facilitate the measurements and the assessment of the deposition bands. A few modifications of the parallel plates spectrometer are described, with the purpose of facilitating the operation, together with a photometric scanner for a rapid assessment of deposition bands in location and concentration. With the aid of this instrument measurements have been made of relative mobilities of latex aggregates and of the number of elementary charges carried by unipolarly charged particles; also, monodispersed aerosol generators were characterized. (Author abstract)

35152 **APTIC NO. 58169**

Meyer, R. A., G. M. Hidy, and J. H. Davis

DETERMINATION OF WATER AND VOLATILE ORGANICS. *Environ. Letters, 4(1):9-20, 1973. 9 refs.*

A simple technique has been developed for measuring the water content in filter-collected aerosols using a gas chromatograph and for simultaneously determining, semi-quantitatively, the total organics that are volatilized for the collected aerosol at approximately 110 C. The chamber for sampling the aerosols collected on the filters consists of a piston-closed vessel which holds a single filter with minimum air volume. Solenoid valves are machined into the bottom of the chamber to direct a gas flow through the vessel into the analytical instrument. The sample chamber is thermally controlled by heating and cooling tubes. Background filters, exposed only to filtered air, must be provided as a correction since even traces of water vapor absorption on the glass fiber filters will produce potentially significant error in the results. Typical values of the water content derived by filter-chromatography procedure are listed and indicate that the method has water detection limits of 20 micrograms based on a 9.8 micrograms standard deviation of the glass fiber filter background of 45 micrograms. The aerosol sampled under ambient atmospheric conditions will experience significant changes in apparent liquid water content with changes in humidity during the sampling period; hence, the procedure will not represent a simple averaged liquid water content but rather a water fraction that is representative of the particulate when equilibrated with air of the humidity present at the end of the sampling period.

35153 **APTIC NO. 58979**

Mulik, J., R. Fuerst, M. Guyer, J. Meeker, and E. Sawicki

DEVELOPMENT AND OPTIMIZATION OF TWENTY-FOUR HOUR MANUAL METHODS FOR THE COLLECTION AND COLORIMETRY ANALYSIS OF ATMOSPHERIC SO2. *Preprint, National Environmental Research Center, Research Triangle Park, N. C., Lab. Measurements Research Section, 34p., Sept. 19, 1973. 26 refs.*

Manual 24-hour colorimetric procedures for the determination of atmospheric nitrogen dioxide based on the collection of NO2 by bubbling ambient air for 24 hr through reagents that form stable nitrite solutions ,were evaluated in an effort to develop methods free of the deficiencies of the alkaline method, viz., variable collection efficiency and positive interference from nitric oxide and other air pollutants. The reagents employed had a 93% collection efficiency over the range of 20-750 micrograms/cu m NO2 with no apparent interferences. The TGS (20 g triethanolamine plus 0.5 g guaiacol plus 0.250 g sodium metabisulfite/l distilled water) absorber utilizing the sulfanilamide-ANSA (0.1% 8-anilion-1- naphthalene sulfuric acid in absolute methanol) colorimetric procedure was found to be the preferred method whenever the sample containing NO2 could not be assayed within 48 hr. (Author abstract modified)

35154 **APTIC NO. 58154**

Nakamura, Keigo

FLUE GAS TEST MATERIAL SAMPLING METHODS: (JIS K 0095-1973). *(Haigasu shiryo saishu hoho (JIS K0095-1973) ni tsuite (2)). Text in Japanese. Kogai (Hakua Shobo) (Pollution Control), 8(5):49-63, Sept. 1973. 3 refs.*

The sampling methods, analytical methods, and absorbent for ammonia, total sulfur oxides, sulfur dioxide, nitrogen oxides, nitric oxide, nitrogen dioxide, chlorine, hydrogen chloride, hydrogen sulfide, and cyanides designated by the Japanese Industrial Standards and the sampling method, maintenance care, inspection, leakage test method, and other special instructions described in the Japanese Industrial Standard K 0095-1973 are discussed. Samplers and their parts, components building methods, and handling instructions for trapping jars and continuous analyzers are presented by diagrams and notes.

35155 **APTIC NO. 58294**

Nishida, Konosuke

THE EVALUATION OF ODOR POLLUTION. *(Akushu no sokuteiho ni tsuite). Text in Japanese. Kankyo Gijutusu (Environ. Conserv. Eng.), 2(5):53-72, 1973. 35 refs.*

Measurement methods for ammonia, methyl mercaptans, hydrogen sulfide, methyl sulfide, and dimethylamine are reviewed. For sensitivity tests for odors, the odorless chamber method, the injection method, the Shuken-Kinoshita method, the saline water balance method, two olfactory test methods, odor jar, odor paper, and comparative odor bags are reviewed. The principles and procedure of each method are discussed. Trapping and concentrating traceable amounts of odor by previously known methods, was unable to give repeated gas chromatography tests to one sample material, because of the change in composition of trapped material with the time. A modified trapping-concentration method developed by the author is described. The test air 50-100 l is suction trapped into a U-shaped trap in a cold medium tank. Three openings of the U-shape trap are closed and the gas is sent through the flow channel into a bag; at this point the trap is taken out of the cold medium. Since this is warmed by the air temperature, low boiling point elements are gasified and flow into the bag. Then the U-shaped trap is put into a heating tank (60-80 C); high boiling point elements are gasified. From an injection tube with 50-100 ml of helium, He is pushed into the trap and residue elements are sent into the bag. The gas flow is constantly measured by a flowmeter, and the relationship between the test material in the plastic bag and the total air quantity is clear. The test material concentrated in the bag is taken out by an injection syringe each time for gas chromatography.

35156 APTIC NO. 58232

Oren, Michael R.

X-RAY FLUORESCENCE ANALYSIS OF SULFUR DIOXIDE IN AMBIENT AIR. *Preprint, Missouri Univ., Columbia, Coll. of Engineering, 55p., May 1973. 22 refs.*

A method for the quantitative analysis of sulfur dioxide content in ambient air from the direct analysis of air sample filters using x-ray fluorescence spectrometry was developed. Impregnated filters are used to collect the SO2 directly onto filter paper. The filter is then exposed to an iron-55 excitation source, and the intensity of the 2.307 Kev K-alpha x-ray of sulfur is measured. The intensity of the S is directly proportional to the S on the filter and therefore the SO2 content of the air is sampled. Analysis of SO2 may be made for amounts greater than or equal to 1.6 mg. This minimum detectable limit requires a minimum air sample time dependent on the ambient SO2 concentration and collection rate of the sampler. A preliminary investigation was made of utilizing the x-ray fluorescence method in the analysis of air particulate samples.

35157 APTIC NO. 57933

Richardson, Jimmy A.

DETERMINATION OF STABLE ELEMENTS IN AIR POLLUTION PARTICULATES BY NEUTRON ACTIVATION ANALYSIS. *Air Force Institute of Technology, Wright-Patterson Air Force Base, Ohio, Nuclear Engineering Dept., AFIT Thesis, IAW AFR 190-17, Rept. GNE/PH/73-4, 114p., June 1973. 19 refs.*

NTIS, DDC: AD-764715

Neutron activation analysis was used to determine the quantities of 13 elements in samples of atmospheric particulate matter. Quantities ranged from 0.35 microgram of selenium to 34 mg of calcium, which were 0.0002% to 15% of the samples by weight. Twelve other elements were identified, but not quantified. An 80 cu cm lithium-drifted germanium detector with a resolution of 2.2 keV (FWHM) at 1.33 MeV and a 4096-channel analyzer were used for detection and counting of gamma radiation. Data were analyzed by SAMPO, a CDC 6600 computer program; details on the use of SAMPO are included. Techniques and methods of sample collection, sample preparation in quartz and polyethylene ampoules, and data reduction are reported. Procedures were developed for Air Force Institute of Technology students to perform neutron activation analysis as a laboratory exercise. The importance of uniform neutron flux, absence of contamination, and accurate, known standards is emphasized. The spectra obtained by the Ge (Li) detector is compared to that from a 3 in. by 3 in. sodium iodide detector when samples were irradiated by fast neutrons produced by a 150-keV Cockcroft-Walton accelerator. (Author abstract)

35158 APTIC NO. 57910

Tiwari, Surendra N.

APPROPRIATE LINE PROFILES FOR RADIATION MODELING IN THE DETECTION OF ATMOSPHERIC POLLUTANTS. *Old Dominion University, Norfolk, Va., Dept. of Engineering, National Aeronautics and Space Agency Contract NAS1-9434-53, Task 53, NASA CR-132303, 50p., March 1973. 45 refs.*

NTIS: N73-29672

bsorption by Lorentz, Doppler, and Voight lines are compared for a range of atmospheric parameters. For the intermediate path lengths, the use of the combined Lorentz-Doppler (Voight) profile is essential in calculating the atmospheric transmittance. A brief review of band models, to approximate the absorption over certain frequency intervals, is presented. Expressions for total radiative energy emergent from the atmosphere are given which, with appropriate line or band models, can be used to reduce the data obtained from radiation measurement by an instrument mounted on an aircraft or a satellite. By employing the inversion procedure, the concentration of atmospheric pollutants can be obtained from the measured data. (Author summary)

1972

35159 APTIC NO. 58296

Brenchley, David L. and Timothy E. Carpenter

MONITORING AEROSOL CONCENTRATIONS WITH PIEZOELECTRIC CRYSTALS. *Harvard Univ., Cambridge, Mass., Harvard Air Cleaning Lab., Atomic Energy Commission, Div. of National Safety, Waste Management, and Transportation, and Oak Ridge National Lab., Tenn., Atomic Energy Commission Air Cleaning Conf., 12th, Oak Ridge, Tenn., 1972. 12 refs. (Aug. 28-31.)*

A review of the current literature concerning the theory and application of piezoelectric crystals for monitoring aerosol concentrations is presented along with work performed to adapt the piezoelectric crystal for use in conjunction with a cascade impactor. Presently there are two commercially available piezoelectric particle mass monitors. One uses an electrostatic precipitator collector, while the other uses a single-stage inertial impactor. Both units have been tested for use in ambient and source monitoring of aerosols. Adaptation of a piezoelectric crystals for use in conjunction with a cascade impactor has resulted in a four-stage piezoelectric cascade impactor. The impactor design is similar to that of the Battelle impactor, and the mass sensor system consists of one crystal at each stage and one reference crystal. The signals of the monitoring crystal and the reference crystal are mixed and the difference frequency obtained so that ambient effects such as temperature changes are subtracted out and only changes due to mass detected. This type of instrument can be used to accurately and quickly determine the particle size of ambient concentrations. It might also be used for source monitoring with certain modifications.

35160 APTIC NO. 57825

Courbon, P., C. Froger, and J. C. Martin

A NEW DEVICE FOR MEASURING RESPIRABLE DUST IN UNDERGROUND MINES – THE C.P.M. *Ann. N. Y. Acad. Sci., vol. 200:784-790, 1972.*

A new device for measuring respirable dust in underground mines has been developed which is easy to operate, self-contained, and capable of trapping sufficient quantities of dust for weighing in routine operations on precision laboratory balances and for subsequent analysis. The device consists of the following: a pre-separating cyclone that traps the largest particles which are normally deposited in the upper respiratory passages; a rotary filter made of polyurethane foam which is mounted in a holder fixed to the shaft of a motor and has a central orifice and an impermeable adhesive film in its two outer surfaces; an electric motor (d.c.) supplied via an electronic voltage-regulating circuit; a power source consisting of an eight-element cadmium- nickel battery; and an integral charging unit. The fine dust that normally settles in the alveoli of the lung is trapped in the foam disc, while the finest particles, usually ejected on breathing out, are discharged. The filter will not clog, and pressure loss caused by the filter body remains constant over the entire sampling period.

35161 APTIC NO. 57851

Fontijn, Arthur, Dan Golomb, and Jimmie A. Hodgeson

A REVIEW OF EXPERIMENTAL MEASUREMENT METHODS BASED ON GAS-PHASE CHEMILU-

MINESCENCE. *Sybron Corp., Princeton, N. J., AeroChem Research Labs., Inc., Office of Naval Research Contract N00014-67-A-0226-0005, NR-098-038, AeroChem TP-283, 36p., Sept. 1972. 179 refs. (Presented at the International Conference on Chemiluminescence, Athens, Ga., Oct. 10-13, 1972.)*

Experimental methods based on gas-phase chemiluminescence are summarized in relation to species concentration measurements and studies of homogeneous reaction kinetics, thermochemistry, gas-surface interactions, temperatures of reaction environments, atmospheric mass transport, and gas dynamics. The majority of chemiluminescence detectors in practical use for monitoring of air pollutants (ozone, sulfur dioxide, oxides of nitrogen) are based on homogeneous gas-phase chemiluminescence. Such detectors inherently possess a high degree of sensitivity, specificity, and simplicity; although not all pollutants participate in useable reactions. Incorporation of a near infrared interference filter (690 nm) between the flame chemiluminescent zone and photomultiplier has permitted the development of a gas-phase nitrogen compounds (ammonia, amines) detector. Flame chemiluminescence methods have also been used for the detection of phosphorus, boron, and halogen compounds in air. Chemiluminescent reactions in the upper atmosphere and artificial chemiluminescence release have permitted measurement of wind, diffusion, and atmospheric composition.

35163 **APTIC NO. 58285**

Kerr, W. B., R. E. McAtee, and L. T. Lakey

THE EVALUATION OF A STACK SAMPLING SYSTEM USING A HELIUM MASS SPECTROMETER LEAK DETECTOR. *Harvard Univ., Cambridge, Mass., Harvard Air Cleaning Lab., Atomic Energy Commission, Washington, D. C., Div. of Occupational Safety and Div. of Waste Management and Transportation, and Oak Ridge National Lab., Tenn., Atomic Energy Commission Air Cleaning Conf., 12th, Oak Ridge, Tenn., 1972, p. 333-345. (Aug. 28-31.)*

NTIS: CONF - 720823

The flow of gas in a 250-foot stack at a chemical processing plant was measured, and an isokinetic stack sampler obtained a sample representative of the several streams entering the stack. Evaluation was accomplished without direct access to the stack by determining the helium concentration in a stack gas sample stream when helium was released into separate waste gas streams. A helium mass spectrometer leak detector was modified to provide a continuous record of the helium concentration in the stack gas sample. Concentration in the stack sample stream was consistently lower for releases into the several smaller streams than for releases into the main ventilation stream; and deviations varied from minus 4 to minus 13%, averaging minus 8.5% for five systems. Mixing of the various streams was not complete, but the sample represented at least 87% of any one stream. These variations were considered small, and the sampler was deemed adequate for sampling the stack. (Author abstract modified)

35163 **APTIC NO. 58250**

Konosu, Hisao, Yo-ichiro Mashiko, and Masato Sato

DESIGN OF A NONDISPERSIVE VACUUM ULTRAVIOLET PHOTOMETER AND ITS APPLICATION TO TECHNICAL GAS ANALYSIS. *Translated from Japanese. Nippon Kagaku Kaishi (J. Chem. Soc. Japan), no. 1, 17p., 1972. 21 refs. (Presented at Chemical Research for Fire Prevention Meeting, 11th, Jan. 1971.)*

A nondispersive vacuum ultraviolet photometer was developed for continuously recording the concentration of two component gaseous or liquid systems. It is essentially a single beam instrument using the nondispersion principle. The photometer measures the relative intensities in the wavelength range of 1650-2000 A between the reference gas (nitrogen or air) and the sample gas. The following amounts (vol%) of gases and their approximate range were determined: 0.0002-0.5 nitrogen dioxide, 0.0005-0.4 nitric oxide, 0.006-1 oxygen, 0.09-16 carbon dioxide, 0.0002-0.12 ethylene, 0.0001-0.09 CH3CH double bond CH2, 0.002-1.3 acetylene, 0.08-60 CH3CH2CH3, 0.00003-0.05 C6H4, and 0.00003-0.03 C6H5CH3. The coefficient of variation was less than 1%. The deviation of the method was approximately + or 4%. This method may be applied to the continuous analysis of chemical processes and toxic gases in the atmosphere. (Author abstract modified)

35164 **APTIC NO. 57923**

Lyon, W. S., L. C. Bate, and J. F. Emery

ENVIRONMENTAL POLLUTION: USE OF NEUTRON ACTIVATION ANALYSIS TO DETERMINE THE FATE OF TRACE ELEMENTS FROM FOSSIL FUEL COMBUSTION IN THE ECOLOGICAL CYCLE. *Preprint, Oak Ridge National Lab., Oak Ridge, Tenn., Analytical Chemistry Div., 14p., 1972 (?). 6 refs.*

NTIS: CONF 7204131

The trace element profile through a coal-fired steam plant was studied. In cooperation with the Tennessee Valley Authority (TVA) Coal and air entering a TVA steam plant was sampled along with all the wastes and emissions from the combustion of the coal. Thus samples of slag, various precipitors in the gas stream pathway, and finally the exhaust gas of the steam plant were obtained. These samples are being analyzed by neutron activation analysis (NAA) both non-destructively and by dissolution and chemical separation of certain elements. In addition, some samples were analyzed by spark source mass spectrometry (SSM) and these results compared with those from NAA. Flameless atomic absorption was used to determine Hg in many of these samples and comparison with NAA indicates excellent agreement; this latter point is further substantiated by results obtained from determination of Hg in a series of U. S. Bureau of Mines round-robin coal samples. The data from these studies have importance in the overall study of trace elements in all living systems since most of the effluent material from these steam plants finds its way back into the ecological cycle. Neutron activation analysis thus provides important information in assisting governmental agencies to plan for proper control and disposal of such waste materials.

35165 **APTIC NO. 57924**

Menzies, Robert T.

MONITORING ATMOSPHERIC POLLUTANTS WITH A HETERODYNE RADIOMETER TRANSMITTER-RECEIVER. *(National Aeronautics and Space Administration, Pasadena, Calif.) U. S. Pat. Appl. 237,694. 29p., March 24, 1972. (Claims not included with this paper).*

NTIS: N73-29436

The presence of selected pollutants can be determined by transmitting an infrared laser beam of proper wavelength through the atmosphere and detecting the reflections of the transmitted beam with a heterodyne radiometer transmitter-receiver using part of the laser beam as a local oscillator. The laser beam wavelength selected determines the particular pollutant to be detected. When the round-trip path for the light is known or measured, average concentration can be determined by detecting the absorption of the laser beam reflected. The concentration is proportional to a ratio of measured absorption to path length. Upon tuning the laser transmitter-receiver over a narrow frequency region which includes the absorption line of the pollutant of interest, and at each frequency determining the total absorption, absorption versus frequency data is obtained which yields a bell shaped curve. That curve is comprised of a composite of Lorentzian-shaped curves of various half widths. Each Lorentzian- shaped curve corresponds to average absorption in a particular altitude segment. Plotting the amplitudes of the Lorentzian shaped curves yields an altitude profile. Analysis for this altitude profile of pollutant concentration is preferably carried out mathematically in a programmed computer. The novelty of this invention resides in the use of a heterodyne radiometer transmitter-receiver to obtain absorption data to determine the presence, concentration, and altitude profile of pollutant concentration. (Author abstract)

35166 **APTIC NO. 58278**

Sunahara, H., M. Goto, and F. Korte

POSSIBILITIES AND PROBLEMS OF AUTOMATIC MEASUREMENTS OF ENVIRONMENTAL CHEMICALS. *In: Environmental Quality and Safety: Chemistry, Toxicology and Technology. Frederick Coulston and Friedhelm Korte (eds.), Vol. 1, New York, Academic Press, Inc., 1972. p. 189-209. 43 refs.*

The parameters for air and water quality, the establishment of air and water quality criteria, and the efforts made in the USA and Japan for monitoring concentrations of a number of compounds in these media, are discussed. Efficient automatic monitoring systems (including systems for sampling, treatment, detection and determination, and data processing) for important pollutants in air and water are described in detail. The air concentrations of sulfur dioxide, nitric oxide, nitrogen dioxide, carbon monoxide, total oxidants, total hydrocarbons, hydrogen sulfide, hydrogen fluoride, and dust or air particulates have been continuously monitored. Colorimetry, conductimetry, coulometry, non-dispersive infrared spectrometry, gas chromatography, flame ionization detectors, and ion-electrode methods are discussed.

1971

35167 **APTIC NO. 57787**

Altshuller, A. P. and Richard D. Cadle

NOTES ON MONITORING AIR QUALITY. *In: Man s Impact on the Climate. William H. Matthews, William W. Kellogg, and G. D. Robinson (eds.), Cambridge, Mass., MIT Press, 1971, Chapt. 30, p. 375-391. 10 refs.*

Several aspects of monitoring for the following atmospheric pollutants are discussed; hydrocarbons; nitric oxide and nitrogen dioxide; carbon monoxide; heavy metals; organic chlorides; ammonia in the troposphere; sulfates; nitrates; and organic particles in the troposphere; tropospheric ozone; and stratospheric particulate matter. Each pollutant is examined in terms of reasons for monitoring; pollutant sources, routes, and reservoirs; in situ and remote monitoring technology; and capital and operating costs.

35168 **APTIC NO. 58140**

Guilbault, G. G. and A. Lopez-Roman

USE OF SODIUM TETRACHLOROMERCURIATE AS A SUBSTRATE FOR THE DETERMINATION OF SO2 ON THE PIEZOCRYSTAL DETECTOR. *Environ. Letters, 2(1):35-45, 1971. 14 refs.*

An experimental glass-tight piezoelectric crystal cell has been developed for studying gas-solid reactions on piezoelectric quartz crystals, and several substrates have been evaluated for the determination of ambient sulfur dioxide by the West-Gaeke reaction. Sodium tetrachloromercuriate showed the best results and adsorbed from 0.18 to 4.01 micrograms of SO2 in 15 min. The crystals used in the studies were 9 MHz quartz crystals with a plated metal electrode (7.9 mm diameter); and the operating voltage chosen to be applied to the oscillator was 5.5 volts. Temperature constancy was found necessary during the readings, although a change of 10 C was not critical.

35169 **APTIC NO. 57784**

Idso, S. B.

THE UTILITY OF DIFFUSE SKYLIGHT MEASUREMENTS IN CHARACTERIZING LOW LEVELS OF PARTICULATE AIR POLLUTION. *Atmos. Environ., vol. 5:599-604, 1971. 3 refs.*

Measurements of direct and diffuse solar radiation, surface temperature, vapor pressure, and atmospheric dust content were made at two localities on the outskirts of Phoenix, Arizona. Total transmittal of the atmosphere for the combined direct plus diffuse solar radiation on two days of light to moderate air pollution with different dust contents but nearly identical amounts of precipitable water aloft were nearly identical, whereas ratios of diffuse to direct solar radiation were quite different. Hence, the utility of diffuse skylight measurements to provide a detailed characterization of light to moderate particulate air pollution episodes was demonstrated. (Author abstract modified)

35170 **APTIC NO. 57777**

Jepson, Anders F. and Lee Langan

MONITORING MERCURY VAPOR NEAR POLLUTION SITES. *Environmental Measurements, Inc., San Francisco, Calif. Environmental Protection Agency Grant 16020 GLY, Water Pollution Control Research Series 16020 GLY 05/71, 76p., May 1971. 17 refs.*

GPO

Field and laboratory measurements were made to demonstrate that mercury vapor in the air near mercury-polluted water or sediment could be detected using an extremely sensitive atomic absorption spectrophotometer, specifically designed and built to isolate the 2536.5 A emission and absorption spectra characteristic of atomic Hg vapor. Laboratory studies demonstrated that the Hg spectrometer was sensitive only to atomic Hg, although organic compounds could be converted to the metallic form by pyrolysis or combustion and detected. Anomalous Hg levels ranging from 50 to more than 20,000 nanograms/cu m were detected, and ambient air concentrations varied from 0 to 50 nanograms/cu m.

35171 **APTIC NO. 57781**

Ke, Paul J. and Lloyd W. Regier

DETERMINATION OF FLUORIDE IN SOILS BY A NONFUSION DISTILLATION PF METHOD. *J. Fish. Res. Bd. Can., 28(7):1055-1056, 1971. 6 refs.*

A nonfusion distillation pF method has been successfully applied to the determination of fluoride in soils. Fluoride was distilled from the soil sample with perchloric acid and measured in the buffered distillate by an ion-specific fluoride electrode without any ashing or separation operations. Soils or mud containing fluoride in the range between 1-700 ppm were directly analyzed with a standard error of less than 1.5%. Direct weighing of the sample into the distillation flask with no prior treatment eliminated all question of possible fluoride loss before distillation. (Author abstract modified)

35172 **APTIC NO. 57785**

Selucky, M. L.

SPECIFIC GAS CHROMATOGRAPHY DETECTORS. *Chromatographia, 4(9):425-434, 1971. 46 refs.*

Definitions, instrument design, operating characteristics, and applications are reviewed for gas chromatography detectors, particularly those of the flame-photometric type. High specificity to sulfur and phosphorus is characteristic of the flame photometric detector which is very stable and easy to operate. Minimum detectable quantities of S and P are 200 and 40 picograms, respectively. Linearity range is 0.2-300 times 10 to the minus 9 g for P and 0.2-100 times 10 to the minus 9 g for S on a log-log scale at mole% S under 50. Noise level is 4 times 10 to the minus 10 amp. Flame photometric detection permits analysis of airborne sulfur compounds such as sulfur dioxide, hydrogen sulfide, methyl mercaptan, and carbon disulfide down to the ppb level; and, since the response to sulfur compounds depends on the molar percentage of S in the mixture, the FPD can be employed either as a gas chromatographic detector or for total analysis without preliminary separation of the mixture. Standard detectors are a combination of flame ionization, S-FPD, and P-FPD in one detector (simultaneous operation with one column effluent without splitting). (Author abstract modified)

35173 APTIC NO. 58282

Thompson, William L., III

EARTH SURVEY BIBLIOGRAPHY: A KWIC INDEX OF REMOTE SENSING INFORMATION. *Transportation Systems Center, Cambridge, Mass., DOT-TSC-NASA-70-1, R1017, 268p., Feb. 1971. 1655 refs.*

NTIS: N71-26398

A bibliography of 1650 citations on remote sensing of the physical characteristics of the earth is presented. This bibliography is intended to be used as a source document leading to additional information. The scope ranges from detailed technical articles on film selection to general discussions on the politics of earth survey operations. The bibliography is divided into a listing of the bibliographic citations by local accession numbers, a key-word-in-context (KWIC) index, and an author index. (Author abstract modified)

1970

35174 APTIC NO. 58223

Leonardos, Gregory

THE PROFILE APPROACH TO ODOR MEASUREMENT. *Air Pollution Control Assoc., Pittsburgh, Pa., Proc. Air Pollution Control Assoc., Mid-Atlantic States Sect., Semi-Annu. Tech. Conf. Odors Detect., Meas. Control, New Brunswick, N. J., 1970, p. 18-35. 5 refs. (May 13.)*

Human perception is the best instrument available for the measurement of odor. The quantitative aspect of odor is the intensity or strength of response. Intensity is generally accepted to be a logarithmic function of the concentration of the chemicals responsible for odor. The profile method is an analytical method for describing the various aspects of odor sensation. Trained people (four to six in a panel) described the odor to be tested with common descriptive terminology and a four-point scale-recognition threshold (slight, moderate, strong, and none). The odor properties of commercially important chemicals were studied, and odor thresholds for 70 chemicals were determined using the profile method. The odor test room, the panel sniff procedure, the methods of odorant presentation, parameters which can effect results, and the results are described. Isolation and identification of various air and water pollution odorants during various studies are reviewed. Odor surveys have been made by profile-trained analysts. The odor thresholds for many chemicals are listed. Gas chromatographic methods, the dilution syringes, the odor test facility, and the differences between identifications by trained and untrained personnel are mentioned.

1969

35175 APTIC NO. 58654

Deuringer, Rudolf

OZONE SCAVENGER. *(Beckman Instruments Inc.) U. S. Pat. 3,433,580. 2p., March 18, 1969. 6 refs. (Appl. April 6, 1965, 7 claims).*

A silver body is treated in such a manner that the silver destroys ozone but does not affect sulfur dioxide at the levels that these pollutants are normally found in the atmosphere. This treatment involves first the formation of silver sulfide on the silver and, then, the heating of the silver in an oxygen-containing atmosphere for sufficient time and at a temperature of about 600 C, to oxidize the silver sulfide coating on the silver. When a stream of gas containing both zone and SO2 is passed over a body of silver treated in such a way, the ozone is destroyed but the SO2 is not retained in the silver, thus permitting measurements of SO2 by instruments which are based on the reducing species of this gas.

35176 APTIC NO. 55347

Golikov, V. I. and B. D. Genkovskij

ANALYSIS OF THE ACCURACY OF AN INSTRUMENT FOR MEASURING THE SIZE OF FOG DROPLETS AND AEROSOL PARTICLES. *Actinometry. Atmos. Opt., Proc. 7th Inter-Dept. Conf., Leningrad, May 1968, p. 308-311, 1969. 6 refs. Translated from Russian by C. Long, 3p.*

Analysis of the accuracy of a pulse photometer for measuring the size of fog droplets and aerosol particles is presented. The physical source of information about particle size is the luminous flux due to scattering. Measurement of particle sizes is a process of comparing the luminous flux from a particle with a scale of equivalent luminous fluxes. The possibility of using the instrument is determined by three parameters: the distribution of the relative error gamma along the scale gamma equals delta/u; the resolving power z which cannot be less than the error band; and the number of particle size intervals in the working range p equals 1/2 delta (u max u min). The true scale of the instrument is discrete. Its graph is an error band bounded not by the straight lines, as for the continuous scale, but by the broken lines. The point of intersection of the boundary line of the analyzer channel and the straight line belongs to the equation of a continuous scale. The error in signal measurement, equal to the boundary voltage of the analyzer, can be determined in the confidence interval epsilon u with the required confidence probability or reliability of measurement.

35177 APTIC NO. 58622

Huebner, R.

GAS ANALYZER WITH GAS-SAMPLE ASPIRATION. *(Assignee not given.) U. S. Pat. 3,427,862. 5p., Feb. 18, 1969. 2 refs. (Appl. Feb. 24, 1965, 11 claims).*

A gas analyzer is described which uses a time-constant network to measure the interval during which aspired ambient gas is analyzed in a measuring chamber. Provision is made for sampling at different heights by this portable device as would be done to detect explosive or unsafe conditions in mines where stratified air currents often occur. This is done by providing each different length tube with a built-in impedance such as a resistor or a capacitor which modifies the operating interval to compensate for the variation in the effective volume of the intake tube. Thus, the device need not be readjusted in use as different length tubes are attached.

35178 APTIC NO. 57965

Jouault, Pierre

METHOD OF SAMPLING AEROSOLS BY SUCTION AND DEVICE FOR THE APPLICATION OF SAID METHOD. *(Commissariat a I Energie Atomique Paris (France)) U. S. Pat. 3,438,179. 4p., April 15, 1969. 18 refs. (Appl. Nov. 30, 1964, 5 claims).*

A method of sampling aerosols present in the atmosphere is described. This method comprises drawing a gas stream by suction at a constant rate through a collecting filter. A porous substance, preferably sintered bronze, is mounted in the gas stream below the filter, and the gas is drawn successively through the filter and porous bronze. The head loss across the filter increases as a function of the quantity of aerosols deposited on it. A viscous liquid flows across the bronze, impregnating it, and increasing the head loss as a function of the degree of impregnation. This continues until the sum of the head losses across the filter and the impregnated bronze has a predetermined value indicative of a specific gas flow rate. After this the fluid flow is regulated so that the head loss remains constant as aerosols collect on the filter. Analysis of the filter gives the precise average value of the radioactivity present in the atmosphere during a sampling test.

35179 APTIC NO. [illegible]

Liu, B. Y. H., V. A. Marple, and H. Yazdani

COMPARATIVE SIZE MEASUREMENTS OF MONODISPERSE LIQUID AEROSOLS BY ELECTRICAL AND OPTICAL METHODS. *Environ. Sci. Technol., 3(4):381-386, April 1969. 17 refs.*

A new electrical method for sizing monodisperse aerosols of liquid or solid particles in the 0.03 to 10-micron diameter range involves charging an aerosol at atmospheric pressure and measuring the ratio of the electric mobility of the charged aerosol at two lower pressures. The particle size is then calculated by Millikan's equation for the slip correction to Stokes law. Comparative measurements on monodisperse aerosols of dioctyl phthalate (DOP) by this method and of the aerosol owl gave results agreeing within the limit of error of these methods. The somewhat smaller sizes of the same DOP aerosols indicated by a single particle optical counter can be accounted for by the difference in the refractive indices of DOP (1.49) and the polystyrene latex particles (1.58) used in calibrating the optical counter. (Author abstract)

35180 APTIC NO. [illegible]

Llewellyn, Peter M.

GAS INLET SYSTEM FOR GAS ANALYZERS AND GAS ANALYZING SYSTEM EMPLOYING SAME. *(Varian Associates) U. S. Pat. 3,421,292. 6p., Jan. 14, 1969. 5 refs. (Appl. June 6, 1966, 1 claim).*

A device is described for connecting a gas chromotograph (g.c.) with a gas analyzing system such as a mass spectrometer which will increase the ratio of liquefiable gases to fixed gases. Even though the ratio of the desired gas to the g.c. carrier gas may be as high as 1 to 100,000, it will be detected by the spectrometer. Secondly, the device allows for the reduction in pressure from the operating g.c. pressure which is essentially one atmosphere to that required by the mass spectrometer which is in the range of 0.01 to 0.000,000,01 atmospheres. This is all accomplished by a membrane type separator. One side of the membrane is in the stream emitting from the gas chromatograph and the other is under vacuum and is in contact with the mass spectrometer. The membrane is a solid-liquid system similar to the column packing material in the chromatograph. In order for a gas to pass through it, it must first dissolve in the liquid phase. If the liquid phase is similar to the one separating the desired components in the chromatograph, it will pass those components preferentially to the carrier gas.

35181 APTIC NO. 57836

Lodge, James P., Jr. and Martha P. Lodge

ANALYSIS OF MICRON-SIZED PARTICLES: DETECTION OF IRON. *Anal. Chim. Acta, 44(2):452, Feb. 1969. 3 refs.*

An unequivocal method of identification of iron in particles yielding as little as 0.1 pg of soluble iron is described. Atmospheric samples were collected on membrane filters and stained blue by ammonium hexacyanoferrate-III. The filters were treated with hydrochloric acid for 20 min and with nitric acid for 10 min. After this treatment, the samples yielded blue halos. A particle mass computed as iron (III) oxide based on the microscopic size of the particle residue in the center of each halo was assigned.

35182 APTIC NO. [illegible]

Lyshkow, Norman A.

COLORIMETRIC REAGENT FOR ANALYSIS OF SULFUR DIOXIDE IN AIR. *(Precision Scientific Co., Chicago, Ill.) U. S. Pat. 3,433,597. 4p., March 18, 1969. 1 ref. (Appl. June 21, 1965, 9 claims).*

A colorimetric reagent for the analysis of sulfur dioxide in air is discussed. Ethylene glycol is added to the conventional West-Gaeke reagent in order to produce an improved reagent suitable for use in the most rapid sensing continuous analyzing instrument. The resulting reagent containing only a minute portion of ethylene glycol provides lower final color intensity than the West-Gaeke reagent, and the color intensity after one minute is essentially the same as that of the West-Gaeke reagent. Consequently, a relatively high percentage of the final color intensity can be achieved in an extremely short response period. After the initial response period, the color development characteristic of the reagent is linear so that the instrument in which the reagent is used can be accurately calibrated. With this method, concentrated hydrochloric acid is used as the bleaching agent, and p-rosaniline hydrochloride as the dyestuff.

35183 APTIC NO. 57861

Robbins, R. C.

CARBON MONOXIDE ANALYZER. *(Stanford Research Inst., Menlo Park, Calif.) U. S. Pat. 3,420,636. 4p., Jan. 7, 1969. 2 refs. (Appl. April 28, 1966, 9 claims).*

A device for the detection and analysis of carbon monoxide is discussed. A known and an unknown gas sample are drawn through two parallel detection loops which may include a filter unit, preheater coil, reaction chamber, and a photometric measuring cell. Each of the parallel reaction chambers contain a charge of activated mercuric oxide which reacts with the carbon monoxide to produce a mercury vapor. The photometric measuring cells detect the difference in Hg concentration between the unknown samples and the known sample and register this as a reading on a galvanometer. This indicates the amount of CO present. At thermal equilibrium, a very large mercury vapor background is present which is carried by the gas into the photometer masking small quantities of mercury vapor produced by reduction of any CO present in the sample. When the nonequilibrium mercury oxide cell was operated at 210 C, the mercury vapor background was reduced by four orders of magnitude and the short exposure time of the gaseous reactant to the mercury oxide was sufficient for complete reaction of the CO.

35184 APTIC NO. 57918

USEFUL APPLICATIONS OF EARTH-ORIENTED SATELLITES. *National Academy of Sciences National Research Council, Washington, D. C., Engineering Div., National Aeronautics and Space Administration Contract NSR 09-012-909, 92p., 1969. 3 refs.*

A satellite could be placed in a sun-synchronous polar orbit at an altitude of 500 miles to provide virtually global coverage, with repetitive observations being made of specific areas about every 17 days. The first-generation ERTS (earth resources technology satellite), designed for a minimum life in orbit of 1 year, would be equipped primarily with three high-resolution television cameras. Two of these cameras would look within the visible spectral range, while the third would look within the near-infrared. Each picture would take in an area of about 100 square nautical miles. These ERTS sensors will be able to identify the spectral significance of a wide variety of soils, plants, and rocks. The spectral significance of a tree or plant varies according to whether the plant is healthy or sick, and this should allow earth resources satellites to detect plant maladies at an early stage, when remedial action may still be possible.

1968

35185 APTIC NO. 57885

Kasugawa, A. and A. Yokochi

ROYCO PARTICLE COUNTER. *(Royco Particle Counter ni tsuite). Text in Japanese. Kuki Seijo (Clean Air-J. Japan Air Cleaning Assoc., Tokyo), 6(4):42-47, Oct. 1968. 12 refs.*

The Royco Particle Counter, produced in the United States, was described. This instrument is a type of photometer with a scattering angle of 90 deg to measure aerosol particle size. The sensitivity of the counter is approximately 0.3 micron, which is determined by the ratio of the electrical pulse height to the optical and electrical noise level. The calibration method of Royco Particle Counter can be explained by the calculation based on Mie scattering theory. This instrument easily measured particle density and scattering simultaneously and instantly. This counter thus was a significant and very useful instrument for aerosol particle size analysis. Sample applications of the counter are described.

1967

35186 **APTIC NO. 58002**

Eguchi, Tadashi, Takao Nishimura, and Susumu Yoshimoto

INSTRUMENTATION OF TOTAL HYDROCARBON ANALYZER OF AUTOMOBILE EXHAUST GAS BY HYDROGEN IONIZATION DETECTOR. *(Suisoen ionka kenshutshuho ni yoru jidosha haikigasu chu no zentankasuiso nodo sokutei suochi no shisaku). Text in Japanese. Bunseki Kagaku (Japan Analyst) (Tokyo), 16(2):239-246, Feb. 1967. 8 refs.*

An instrument with a hydrogen flame ionization detector and a continuous sample inlet system was developed for the measurement of the total hydrocarbon content of automobile exhaust gas. This is one type of high sensitivity gas chromatography. A cylindrical collector electrode is incorporated to obtain good linearity at high hydrocarbon concentrations. The effect of sample flow rate, different carbon number of samples, oxygen, air flow rate, and sampling line heating are graphically represented. The sampling line can be heated to above 100 C. Its small size effectively reduces sample gas transport time. Response to changes in concentration of sample gases is only 2.5 sec, allowing the instrument to follow rapid changes in engine operating conditions. Full-scale sensitivity is 150 to 50,000 ppm C3, in which the range can be selected at will. Hydrocarbon emission concentrations obtained by the instrument were considerably higher but more accurate than those obtained by a nondispersive infrared analyzer.

1966

35187 **APTIC NO. 57896**

Tanny, G. and O. V. Ingruber

THE APPLICATION OF POTENTIOMETRY TO THE DETERMINATION OF TOTAL AND COMBINED SO2 IN SULPHITE LIQUORS. *Pulp Paper Mag. Can. (Quebec), 67(9):T-407-T-413, Sept. 1966. 12 refs.*

The detection of an analytical end-point by the change in potential of a suitable electrode pair normally increases in the precision of a method and is also a condition for its automation. The precision of the conventional Palmrose method, particularly the acidimetric end-point in spent liquor, is improved when the end-point is determined potentiometrically. Chloramine-T, which is less expensive, can be substituted for potassium iodate. The potentiometric determination of calcium and/or magnesium by means of ethylenediamine tetraacetic acid is practical and accurate. In spent liquors, this technique measures the true content of Ca and Mg cations. This method will be of value in cooking studies and for routine analysis related to base recovery. Titration in a non-polar solvent (dioxane) further improves the sensitivity of the end-point detection. A new and accurate method for total SO2 is described. This involves a titration in alkaline solution with silver nitrate using an Ag/AgCl electrode. This method can be of value in neutral sulfite liquors and in highly acid liquors where losses of SO2 are a problem. Consistent differences between combined SO2 as titrated and that calculated from the base content were described by a quadratic regression equation with free SO2 as a factor. (Author abstract modified)

1965

35188 **APTIC NO. 57828**

MERCURY (10)--OFFICIAL, FINAL ACTION. *In: Official Methods of Analysis. W. Horwitz (ed.), 10th ed., 1965, p. 375-377.*

A method for determination of mercury in samples such as fresh or dried fruits and vegetables, beverages, meats, fish, and biological materials is presented which consists of wet digestion of the sample with nitric acid and sulfuric acid under reflux in a special apparatus, isolation of Hg by dithizone extraction, removal of copper, and estimation of Hg by photometric measurement of Hg dithizonate. The critical step is digestion of the sample which must be almost complete, otherwise residual organic matter may combine with Hg and prevent or hinder extraction with dithizone. Oxidizing material in the digest must also have been destroyed or dithizone reagent is decomposed and Hg is not quantitatively extracted. Details are provided on preparation of samples and standard curves.

1962

35189 **APTIC NO. 57994**

Goksoyr, H. and K. Ross

THE DETERMINATION OF SULFUR TRIOXIDE IN FLUE GASES. *J. Inst. Fuel, 35(255):177-179, April 1962. 6 refs.*

The technique described gives a complete determination in less than 15 minutes with good accuracy and repeatability over a fairly wide range of sulfur trioxide concentrations. Sulfur trioxide is retained by condensation as sulfuric acid in a temperature range below its dewpoint. Gas sampling rates up to 10 l/min may be achieved with the collecting apparatus without impairing the accuracy of the method. The sulfuric acid is determined by a simple titration with a well defined end-point. The procedure is reliable as well as convenient.

AIR QUALITY MEASUREMENTS

1974

35190 **APTIC NO. 57938**

Toonkel, Lawrence E., Mindy Schonberg, and Herbert L. Volchok

HASL SURFACE AIR SAMPLING PROGRAM. THE QUALITY OF ANALYSIS - 1972. *In: Health and Safety Laboratory. Fallout Program Quarterly Summary Report. (Sept. 1, 1973 thru Dec. 1, 1973). Atomic Energy Commission, New York, Health and Safety Lab., UC-41, Health and Safety, TID-4500, 61st Ed., p. I-2 to I-5 and I-9 to I-15, Jan. 1, 1974. 5 refs.*

NTIS: HASL-278

The Surface Air Sampling Program measured strontium-89, strontium-90, plutonium, and stable lead. The quality of the radiochemical analysis and the gamma spectrometric analysis was satisfactory. In quality control tests, a tendency toward a negative bias was indicated for most of the gamma spectronalyses. The quality control results from the chemical analysis program are presented in a table. Quality control results for the entire year are also summarized in a table.

35191 **APTIC NO. 57939**

Volchok, H. L., R. Knuth, and M. T. Kleinman

THE RESPIRABLE FRACTION OF SR90, PU239 AND PB IN SURFACE AIR. *In: Health and Safety Laboratory. Fallout Program Quarterly Summary Report. (Sept. 1, 1973* *thru Dec. 1, 1973). Atomic Energy Commission, New York, Health and Safety Lab., UC-41, Health and Safety, TID-4900, 61st Ed., p. I-36 to I-40, Jan. 1, 1974. 2 refs.*

NTIS: HASL-278

A small horizonal elutriator was used to measure the respirable fractions of airborne strontium-90, plutonium-239, and stable lead in Lower Manhattan and at Sterling Forest, N. Y., about 30 miles northwest of the first site. The mean results were greater than or equal to 0.96, 0.84, and 0.82, respectively. (Author abstract modified)

1973

35192 **APTIC NO. 55432**

Gordon, Robert J. and Robert J. Bryan

PATTERNS IN AIRBORNE POLYNUCLEAR HYDROCARBON CONCENTRATIONS AT FOUR LOS ANGELES SITES. *Environ. Sci. Technol., 7(11):1050-1053, Nov. 1973. 11 refs.*

The patterns in airborne particulate matter at four Los Angeles sites were investigated by simultaneous sampling for 1 year. A composite for the year at each site was extracted and analyzed for polynuclear aromatic hydrocarbons (PAH) and lead. The yields of total particulate mass, benzene solubles, Pb, and coronene paralleled the estimated traffic densities at the four sites. A number of PAH, other than coronene, did not parallel traffic density. The PAH patterns, normalized to coronene, were similar for three sites and to a fair degree, resembled patterns for auto exhaust previously published. The fourth site had a distinctly different pattern, reflecting local sources of nonautomotive PAH. Absolute levels of PAH were much below those found before imposition of stationary source emission controls, but have not changed much further since the late 1950 s. The locations were near a freeway, two near industry, and a non-industrial site.

35193 **APTIC NO. 58190**

Hirano, Koichiro, Mitsugu Nakamura, Yoko Endo, Minoru Kitazume, Yoji Yoshinaga, Keiko Okamura, Masao Suzuki, and Etsuo Yoneyama

ANIONS IN SUSPENDED PARTICULATES. *(Fuyu funjin-chu no in-ion). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 8(3):447, Oct. 1973. (Presented at the Japan. Society of Air Pollution, Annual Meeting, 14th, Fukushima, Japan, Nov. 6-8, 1973, Paper 181.)*

The minus ions of nitrate, chloride, sulfate, vanadium, copper, lead, manganese, cadmium, nickel, chromium, and iron, and their relationships with each other, were investigated to see local characteristics of pollution in Yokohama. The measurements were taken at seven locations, and the averages of 10 days and the standard errors were presented in tables. The correlations of Cl with other pollutants were high in the coastal area. In one residential area, NO3 ion was 96.6 micrograms/cu m and was 1.26 times over the industrial area; but the correlation tendencies of these two areas were similar. The SO4 ion showed high correlations with V and Mn, relatively high correlations with Pb and Cd. The Cr, Fe, and dusts had almost no correlation with anything.

35194 **APTIC NO. 58218**

Lee, Robert E., Jr., Jim Caldwell, Gerald G. Akland, and Robert Fankhauser

THE DISTRIBUTION AND TRANSPORT OF AIRBORNE PARTICULATE MATTER AND INORGANIC COMPONENTS IN GREAT BRITAIN. *Preprint, Environmental Protection Agency, Research Triangle Park, N. C., National Environmental Research Center, 30p., 1973 (?). 14 refs.*

Daily measurements of total suspended particulate matter, sulfate, nitrate, ammonium, and fluoride components were made during the heating and nonheating season at six primary and five secondary sites in Great Britain. Samples were collected with high volume air samplers operating for 24-hour periods. The degree of association between the inorganic components were markedly influenced by the total suspended particulate concentration, and a strong relationship was found between sulfate and ammonium concentrations at the primary sites. Wind direction was the most important factor in the particulate concentration levels in Great Britain; and during stagnation conditions or when the wind was predominantly from an easterly or southern direction, i.e., from the northern European continent, particulate levels were highest. Particulate levels were the lowest when the wind was predominantly from a westerly direction, i.e., the Atlantic Ocean. The particle sizes of the total suspended particulates and aerosol components appeared to be sufficiently small to account for their long-distance transport from sources outside of Great Britain. (Author abstract modified)

35195 **APTIC NO. 55435**

Morik, Jozsef, Magdolna Kerteszne Saringer, and Tibor Varkonyi

EXAMINATION OF THE AIR POLLUTION IN DUNAUJVAROS. *(Levegoszennyezodes vizsgalatok Dunaujvarosban). Text in Hungarian. Egeszsegtudomany, 17(3):209-218, 1973. 4 refs.*

Air pollution was measured in Dunaujvaros in 1967 and 1968 to determine whether the population is duly protected against air pollution in a town in which the requirement of the modern town development are already respected. The mean value of the air pollution in Dunaujvaros was a dust deposit of 26.20 g/sq m/30 days, floating dust 165 granules/ml, total sulfur 7.64 mg/100 hr, and sulfur dioxide 0.51 mg/cu m. The modern location of industrial investment assures a more favorable situation with respect to the purity of the air than that in older towns. If more extended industrial establishments with considerable soiling are in a town, the augmentation of the protective distances and strict observation of the protective precautions are indispensable. (Author abstract modified)

35196 **APTIC NO. 58298**

Volchok, H. L., L. Toonkel, and M. Schonberg

RADIONUCLIDES AND LEAD IN SURFACE AIR. *In: Health and Safety Laboratory, Appendix, Fallout Program, Quarterly Summary Report, U. S. Atomic Energy Commission New York, p. B-1-B-10, B-107-B-114, July 1973. 6 refs.*

NTIS: HASL-274

Surface air contamination concentrations from 41 sampling sites are presented for plutonium 29 in 1972 and lead in 1966-1972. The sampling sites are grouped roughly along the 80th Meridian (West). Since 1963 a number of other sites were added to investigate the possible effects of longitude, elevation, and proximity to coastlines, and from late 1965 through March 1969, samplers were placed on four Atlantic Ocean weather ships to extend surface air study over the marine environment. The present network extends from about 76 deg North to 90 deg South. The sampling stations along with their coordinates and elevations are listed.

35197 **APTIC NO. 58117**

Tokyo Metropolitan Government (Japan), Toshima District Dept. of Construction Pollution

REPORT ON THE 1972 INVESTIGATION ON SUSPENDED PARTICULATES. *(Showa 47-nendo fuyu ryushijo busshitsu chosa hokokusho). Text in Japanese. 20p, May 1973.*

A comprehensive investigation was conducted on suspended particulates in the atmosphere of the Toshima district of

Tokyo. Measurements were taken at the First Ikebukuro Elementary School and the Takata Junior High School, periodically between July 1972 and March 1973. Samples were taken for 24 hours each month and the total dusts, lead, iron, manganese, copper, nickel, vanadium, cadmium, zinc, aluminum, and magnesium were measured by atomic absorption spectrophotometry. Generally, the total dusts, Pb, Cd, and Mn at Ikebukuro, and the total dusts, Pb, Cd, and Ni at Takata were very low. The measurements were higher at Ikebukuro for the total dusts, Fe, Mg, Ni, Zn, and Cd. After Dec. 1972, a cyclone was installed in the sampler, and the effect showed that the total amount of dusts was reduced to 20% with the cyclone. When the wind velocity decreased from 2 m/sec to 1 m/sec, the total dusts decreased to approximately half.

35198 **APTIC NO. 58192**

Kobe Municipal Bureau of Environment (Japan), Dept. of Pollution Control

ANALYSIS AND EVALUATION REPORT ON ELECTRONIC COMPUTER SIMULATIONS OF SPECIAL POLLUTION DISTRICTS: A BASIC INVESTIGATION OF SPECIALLY POLLUTED DISTRICTS OF KOBE. *(Tokubetsu kuiki shitei ni kakaru denshi keisan simureshon ni yoru chosa no kaiseki hyoka hokokusho). Text in Japanese. 104p., Oct. 1973.*

Before analyzing the air pollution conditions of specially designated pollution areas of Kobe, the data to be used for computer input were statistically analyzed and given a pretreatment for more accurate output results. Combustion gas emission sources and meteorological conditions were analyzed. From the special topographical condition of Kobe, puff models were introduced for the calculation of combined pollution concentration patterns. A simulation model for sulfur oxides was obtained first, and after confirming the good results, a model for suspended particulates was programmed. The results are presented by tables, charts, graphs, and computer printouts. The hourly average 99% concentrations for SOx in three areas of Kobe are 140, 150, and 150 ppb respectively; 50% are 28, 27, and 33 ppb; the calculation averages are 38, 37, and 42 ppb respectively. Suspended particulates in two areas are 120 and 240 micrograms for 99%, 36 and 60 for 50%, and 38 and 70 for calculated averages.

35199 **APTIC NO. 58213**

Environmental Protection Agency, Research Triangle Park, N. C., Office of Air Quality Planning and Standards

AIR QUALITY DATA FOR ORGANICS 1969 AND 1970 FROM THE NATIONAL AIR SURVEILLANCE NETWORKS. *APTD-1465, 33p., June 1973. 2 refs.*

NTIS: PB 224822/AS

The concentrations of the organic fraction of suspended particulate matter are listed based upon the particulate pollutant data gathered during 1969 and 1970 by the cooperating stations of the National Air Surveillance Networks. The total amounts of benzene-soluble organic compounds and benzo(alpha) pyrene, a polynuclear aromatic hydrocarbon present in the benzene-soluble fraction, were measured in the laboratory using particulate samples collected at urban and nonurban sites. The data are presented in a quarterly composite format. (Author abstract)

1971

35200 **APTIC NO. 58291**

Harris, Thomas B.

VERTICAL PROFILES OF CARBON DIOXIDE IN THE PRESENCE AND ABSENCE OF LARGE LOCAL SOURCES. *Preprint, American Chemical Society, Washington, D. C., 12p., 1971. 5 refs. (Presented at the American Chemical Society, National Meeting, 161st, Los Angeles, Calif., March 28-April 2, 1971.)*

Carbon dioxide measurements made near pollution sources are compared to data taken in the absence of man-made pollution. Vertical profiles of CO2 are shown for Barbados, West Indies, Hawaii, and Buffalo, N. Y. The average of all the samples in Barbados was 320.2 ppm, with a range of only 0.8 ppm. In the Hawaiian sample the average was 323.1 ppm and the range was 3.5 ppm. The results obtained in and around the Buffalo area demonstrate the dependence of dispersion on the meteorological conditions. The air moving into the region had a concentration already enhanced by locales downwind and had a CO2 content of 331 ppm. This concentration was such that + or 6 ppm of this average encompasses any sample value taken at 1000 ft. The average concentration of CO2 for that portion of the sounding 4000 ft and above was 320.8 ppm.

1970

35201 **APTIC NO. 58221**

Silverstein, Jack

TEACHER RECOGNITION AWARD. *Air Pollution Control Assoc., Pittsburgh, Pa., Proc. Air Pollution Control Assoc., Mid-Atlantic States Sect., Semi-Annu. Tech. Conf. Odors Detect., Meas. Control, New Brunswick, N. J., 1970, p. 67-73. (May 13.)*

Ten students were organized into an Air Pollution Detection and Research Club which studied the air pollution in the area of the Northeast High School in Philadelphia. A sampling station was built, and a gas sampling apparatus was constructed. Sulfur dioxide was measured by the West and Gaeke method, nitrogen dioxide by the Saltzman method, aldehydes by the MBTH method, and particulate matter by an improvised high-volume sampler. Samples were collected four times per week except during long school holidays and other times the school was closed. Samples were collected from June 1968 to June 1969. The average concentrations were .0538 ppm SO2, .0088 ppm NO2, .1272 aldehydes, and .0123 g particulates. The results were compared with those obtained by the Philadelphia Environmental Health Laboratory. From 1969 to 1970 the monitoring will be continued for particulate matter and SO2. In another project, the effects of SO2 on geraniums were studied. The plants subjected to SO2 had a greater tendency to drop leaves and poorer growth than other plants. Their leaves curved downward and their appearance was poor.

1969

35202 **APTIC NO. 58247**

Brodniewicz, A. and K. Korzeniowski

DUST CONTAMINATION OF AIR IN THE HEALTH RESORT AND TOWN OF KOLOBRZEG. *(Zapylenie powietrza uzdrowiska i miasta Kolobrzegu). Air Conserv. (English translation from Polish of: Ochrona Powietrza), 3(5):7-12, 1969. 12 refs.*

NTIS: TT 70-55123/5

Observations were made of dust fall in Kolobrzeg. Average values in both the health resort and town areas for both the spring-summer and autumn-winter periods were higher than the standard of 40 tons/sq km/yr. Monthly dust fall values are listed. Dust composition consisted on the average of 50.9% organic substances in the autumn-winter period and 36.1% organics and 17.1% sulfates in the spring-summer period. In the health-resort region dust concentrations varied from 24-129.6 tons/sq km/yr with 87.5% of the readings over the standard, in the industrial-warehouse region concentrations were 30-204 tons/sq km/yr with 94.4% excessive readings, in the town center concentrations were 55.1-187.2 tons/sq km/yr with 100% excessive readings.

1968

35203 **APTIC NO. 58091**

Lux, Herbert

THE IMPORTANCE OF AIR QUALITY MEASUREMENTS FOR THE DIAGNOSIS OF AIR POLLUTION EFFECTS ON FORESTS. *(Die Luftanalyse in der forstlichen Rauchschadendiagnostik). Text in German. Z. Meteorol., 20(1-6):31-36, 1968. 17 refs.*

Air quality measurements over forest areas are primarily helpful in determining whether air pollution may or may not be ruled out as a possible factor in injuries to forest trees. The actual damage, however, is determined by chemical-biological methods. Great difficulties are encountered when it comes to determining toxic limit concentrations. Quite frequently, considerable damage is caused by exceeding the concentration limit by less than 10% of the time during a year. Since in forests there is usually no power supply, and since the terrain is difficult to reach, expensive automatically recording measurement units cannot be set up. For these and other reasons, simple inexpensive units requiring little maintenance are used. These may be the Liesegang unit, the lead peroxide candle, or aspirators, all operating on the principle of cumulative analysis. In addition, short-term sampling units or recording units are employed. The measuring stations are best arranged in the direction of the prevailing wind. Instead of determining short-term peaks of air pollution concentrations, the spatial distribution of air pollutants in the form of long-term averages is better suited in this case. Grid measurements of sulfur dioxide concentrations taken in the Dubner Heide with Liesegang units showed good agreement between the pollutant distribution and areas with injured forest trees. Good agreement was also found with the long-term relative SO2 concentrations computed by Flemming. Interpretation of the results of grid measurements must take into account the distribution of wind directions.

35204 **APTIC NO. 58090**

Neuwirth, R.

AIR QUALITY MEASUREMENTS IN RESORTS. *(Luftreinheitsmessungen an Kurorten). Text in German. Umschau (Frankfurt), 68(20): 631-632, Sept. 26, 1968. 2 refs.*

Air quality measurements were performed in resort cities to determine whether they still qualified as resort areas. For this purpose, vaseline-greased foils were exposed in several places throughout the cities, primarily at the places thought to have the highest or the lowest concentration and at various intermediate locations. The foils were left for a week and were then evaluated in the laboratory. This simple method was selected on the grounds of Jung s discovery that the presence of large particulates (more than 5 micron in diameter) is indicative of the small particulates which penetrate the lungs. The measurements at each site lasted at least one year. The association for the Promotion of Tourism has set a threshold dust concentration of 2.5 g/sq m for 30 days. From June 1959 to February 1968, a total of 25,183 foils had been sent to resort areas. Samples were taken at 121 different sites. Ninety percent of those places assumed to have a low dust concentration stayed below the designated threshold; of the places assumed to have the highest concentration, 60% did. An average of 26% of all sampling sites, however, exceeded the threshold.

1967

35205 **APTIC NO. 58077**

O Connor, John R.

LEVELS OF SELECTED ATMOSPHERIC CONTAMINANTS ENCOUNTERED BY TRANSIT WORKERS IN NEW YORK CITY. *Preprint, 1967. 3 refs.*

An aerometric survey which was designed to measure the levels of atmospheric contaminants that transit workers might be exposed to in their working environment was conducted in New York City during 1965-66. Subway samples from an underground line showed nitric oxide levels about twice those found in the vicinity of an above ground line, while there was little difference in the levels of other gases between the two lines. Concentrations of respirable size particulate matter were consistently higher for the underground line. The concentration of pollutants found on bus routes varied with traffic density, with the Manhattan route showing the highest concentrations. Samples collected at the Brooklyn Navy Yard were more representative of overall exposures encountered by the non-transit worker. Data are given for sulfur dioxide, aldehydes, nitrogen dioxide, and nitric oxide concentrations as well as for respirable size particulates.

ATMOSPHERIC INTERACTION

1974

35206 **APTIC NO. 58172**

Garland, J. A., D. H. F. Atkins, C. J. Readings, and S. J. Caughey

DEPOSITION OF GASEOUS SULPHUR DIOXIDE TO THE GROUND. *Atmos. Environ., 8(1):75-79, Jan. 1974. 8 refs.*

The rate of dry deposition of sulfur dioxide (direct interaction of the gas molecules with the lower boundary of the atmosphere) was obtained for a short grass area in Great Britain from measurements of the variation of concentration with height using a new method to obtain turbulence parameters from temperature and wind speed profiles. Deposition velocity varied widely over time and did not show any clear dependence on weather; mean deposition velocity was 0.0055 m/sec. Approximately 25% of the SO2 emitted within Great Britain would appear to be deposited by dry deposition within the area studied, assuming that the deposition velocity value found applies to the countryside as a whole and using the mean concentration of 41 micrograms/cu m found by Meetham. (Author abstract modified)

35207 **APTIC NO. 58130**

Owers, M. J. and A. W. Powell

DEPOSITION VELOCITY OF SULPHUR DIOXIDE ON LAND AND WATER SURFACES USING A 35S TRACER METHOD. *Atmos. Environ., 8(1):63-67, Jan. 1974. 11 refs.*

The absorption of sulfur dioxide onto rural land and simulated sea water surfaces was studied by means of field trials using SO2 labelled with (35)sulfur; the effect of hedgerow was also examined. Deposition velocity measurements from the field trials and in the literature suggested that the average deposition velocity for SO2 over the British Isles is likely to be about 0.8 cm/sec for concentrations measured 20 cm above the surface. (Author abstract modified)

35208 **APTIC NO. 58171**

Shepherd, J. G.

MEASUREMENTS OF THE DIRECT DEPOSITION OF SULPHUR DIOXIDE ONTO GRASS AND WATER BY THE PROFILE METHOD. *Atmos. Environ., 8(1):69-74, Jan. 1974. 13 refs.*

Measurements of the rate of direct (dry) deposition of sulfur dioxide onto grass and water were made by the profile method. Deposition velocity over grass in a polluted area was about 8 mm/sec in summer and 3 mm/sec in the autumn, yielding surface resistances of about 80 sec/m and 300 sec/m, respectively. These values were comparable with stomatal resistances in open and closed conditions. There appeared to be little dependence on wind speed since the deposition process seemed normally to be limited by surface resistance. Deposition velocity onto water was proportional to friction velocity and hence roughly proportional to wind speed, as would be expected for a deposition process which was diffusion-limited. It was, however, somewhat smaller than theoretical estimates for the situation, being about 0.001 of the wind speed at a height of a few meters. (Author abstract modified)

1973

35209 APTIC NO. 58717

Bischof, W. and P. Fabian

MERIDIONAL TROPOSPHERIC OZONE DISTRIBUTION NORTH OF 50 DEG FROM AIRPLANE MEASUREMENTS. *Pure Appl. Geophys. (Basel), vol. 106-108:1041-1043, 1973. 2 refs.*

Ozone measurements aboard commercial airliners over Scandinavia and on transpolar flights were analyzed for tropospheric ozone concentration. The results confirm the existance of a region of enhanced stratospheric-tropospheric exchange around 60 deg latitude, which was expected from strontium-90 fallout measurements. (Author abstract)

35210 APTIC NO. 57940

Bowne, Norman E.

DIFFUSION RATES. *Preprint, Air Pollution Control Assoc., Pittsburgh, Pa., 19p., 1973. 23 refs. (Presented at the Air Pollution Control Association, Annual Meeting, 66th, Chicago, Ill., June 24-28, 1973, Paper 73-130.)*

The Gaussian diffusion model is described as a method of studying atmospheric dispersion. The ease of application of this model for conservative pollutants outweighs its shortcomings as a complete mathematical description of diffusion. Most engineers employing this model use the classicial dispersion rates originally designated by Pasquill and Gifford. Turner s work has provided additional impetus to use of this model, often by engineers not familiar with either the mathematics of the model or the experimental data used to determine the dispersion rates. A set of three families of dispersion curves is presented, based on experimental data gathered since 1963, to yield dispersion rates appropriate to urban and suburban areas, as well as the rural areas appropriated to the Pasquill and Gifford curves. McElroy and Pooler s curves for urban rates are extended to shorter distances, and a set of curves appropriate to surburban areas or heterogeneous topography are proposed. (Author abstract modified)

35211 APTIC NO. 58244

Deevey, Edward S., Jr.

SULFUR, NITROGEN, AND CARBON IN THE BIOSPHERE. *Brookhaven National Lab., Upton, N. Y., Carbon Biosphere, Proc. Brookhaven Symp. Biol., 24th, Upton, N. Y., 1972, p. 182-190, Aug. 1973. 26 refs. (May 16-18.)*

NTIS: CONF 720510

Sulfur, nitrogen, and carbon have closely analogous biogeochemical cycles, closure of which requires a biological reduction step. The cycles are coupled by the occurrence of all three elements in reduced form (as protein) in the biosphere, steady synthesis of which demands the coexistence of reducing environments, such as soil, deep water, and mud, with oxidizing water and air. On a global basis, reduction (fixation, metabolism) of C, N2, and S proceeds at rates related to 10:1:1, respectively, although the biospheric proportions, by weight, are 554:7:1. Quantitative budgets are uncertian due to unevaluated and unproved emissions from anaerobic to aerobic environments. About half the S that moves through the atmosphere annually is S(34)-depleted, and therefore is biogenic and must come from the ocean in sulfide form; but emissions of hydrogen sulfide to the atmosphere have not been detected. Accelerated recycling of the three elements plus phosphorus, suspected as a consequence of pollution, can be both the cause and effect of eutrophication, which is organic overloading. In general, eutrophication, by increasing the proportion of anaerobic to aerobic environments, can change the mean redox state of the oceans or of the globe. The redox state has varied remarkably over Phanerozoic time. Several lakes are discussed as examples of these processes. (Author abstract modified)

35212 APTIC NO. 58261

Donaldson, Coleman duP.

DERIVATION OF A NON-BOUSSINESQ SET OF EQUATIONS FOR AN ATMOSPHERIC SHEAR LAYER. (INTERIM REPORT). *Aeronautical Research Assoc. of Princeton, Inc., Princeton, N. J., Environmental Protection Agency Contract 68-02-0014, Program Element A-11009, EPA-R4-73-016b, 186, vol. 2, 90p., March 1973. 5 refs.*

NTIS: PB-225525/8AS

A detailed derivation of the equations which describe the generation turbulence in the atmosphere and the equations which govern the transport of pollutants in the atmosphere is presented. The equations are valid for motions which are small departures from an atmosphere at rest and in adiabatic equilibrium, but the usual assumption that the motion is restricted to thin layers, which leads to the Boussinesq approximation, is relaxed. (Author abstract)

35213 APTIC NO. 58242

Ehhalt, Dieter H.

METHANE IN THE ATMOSPHERE. *Brookhaven National Lab., Upton, N. Y., Carbon Biosphere, Proc. Brookhaven Symp. Biol., 24th, Upton, N. Y., 1972, p. 144-158, Aug. 1973. 39 refs. (May 16-18.)*

NTIS: CONF 720510

The atmospheric cycle of methane is described. Most of the CH4 released to the atmosphere is of recent biologic origin. Carbon 14 analyses have shown that, at most, 20% of the atmospheric CH4 is released by fossil sources. The estimated total annual production of CH4 is between 6.5 times 10 to the 14th power and 19 times 10 to the 14th power g/yr. The destruction of CH4 takes place mainly in the troposphere, most probably through the reaction methane + hydroxide yields methyl + water. The total destruction rate is 3 times 10 to the 15th power g/yr. The CH4 cycle contributes about 1% to the atmospheric carbon cycle. The average volume mixing ratio in the troposphere is 1.41 ppm, which corresponds to a total amount of 4 times 10 to the 15th power g of CH14 present in the atmosphere. Thus the turnover times of atmospheric CH4 range from 1 to 6 years. The vertical CH4 profiles in the troposphere show no large systematic gradients. In the stratosphere the CH4 mixing ratio decreases with altitude, reaching 0.25 ppm at 50 km. The isotopic composition of atmospheric CH4 and its sources are discussed briefly. Sources include paddyfields, swamps, enteric fermentation of animals, forests, fields, humid tropical areas, and coal fields. Sinks for atmospheric CH4 include the destruction reaction mentioned above, loss to the stratosphere in Hadley circulation, and loss to the stratosphere by vertical eddy diffusion. (Author abstract modified)

35214 APTIC NO. 58716

Fabian, P.

A THEORETICAL INVESTIGATION OF TROPOSPHERIC OZONE AND STRATOSPHERIC-TROPOSPHERIC EXCHANGE PROCESSES. *Pure Appl. Geophys. (Basel), vol. 106-108:1044-1057, 1973. 18 refs.*

Based on the global distribution of various surface types, the mean tropospheric residence time gamma of ozone is estimated as a function of latitude. Due to the land-sea distribution, gamma varies from 30 days in the northern hemisphere to 190 days in the southern hemisphere. For the stratospheric-tropospheric exchange, a sinusoidal variation with season is assumed. The annual variation of tropospheric ozone thus gets a sine function from the mean, amplitude, and phase of which the injection function for the particular latitude can be determined. (Author summary)

35215 APTIC NO. 57916

Ferber, Gilbert J. and Robert J. List

LONG-RANGE TRANSPORT AND DIFFUSION EXPERIMENTS. FINAL REPORT. *Air Resources Labs., Silver Spring, Md., National Oceanic and Atmospheric Administration, Dept. of Defense Contract VT/1416, Program Code 1F10, Advanced Research Projects Agency Order No. 1841, 82p., May 1973. 7 refs.*

NTIS, DDC: AD 764893

The feasibility of conducting long-range atmospheric tracer experiments to study transport and diffusion of gaseous plumes over continental distances was investigated. A series of experiments in which a tracer gas would be released in the western U. S. and cross-country air sampling would be carried out to determine the distribution of the tracer as a function of time and distance from the source, at ground level and aloft, were considered. The first alternative involves using Krypton-85 emitted from a nuclear fuel reprocessing plant to obtain long-range plume data. Detection of a Kr-85 plume is feasible at distances to at least 1600 km. The second alternative is to develop new tracers and techniques for continental-scale experiments. Potential long-range tracers investigated include sulfur hexafluoride (SF6) and two fluorocarbons 12B2 (CF2Br2) and 114B2 (C2F4Br2). All are detectable by electron-capture gas chromatography at extremely low concentrations. A field experiment was conducted in Sept. 1972 to test equipment and techniques for release, sampling and analysis of 12B2 and 114B2 and to obtain plume data to a distance of 90 km. These tracers, along with SF6, Kr-85, methyl iodide, and uranine dye were released from a 76-meter stack over a 3-hour period. The alternative experimental approach using Kr-85 is recommended for more immediate results. Instead of extensive cross-country sampling of plumes from a relatively few releases of special tracers, a more limited long-range sampling of the existing plume emanating from the National Reactor Testing Station in Idaho is proposed. Cryogenic sampling equipment will be installed at 10-15 National Weather Service stations along an arc from Minnesota to Texas, about 1500 km from the source. Twice-daily samples will be collected over a 4-month period. At this distance the plume will go through diurnal cycles of wind and stability conditions and will also show the effects of passage over mountainous terrain. Sample concentrations will be related to source strength, meteorological trajectories, wind speed, and stability. Results will be used to develop a model of plume transport and diffusion to a distance of several thousand km.

35216 APTIC NO. 58343

Hill, Frank B.

ATMOSPHERIC SULFUR AND ITS LINKS TO THE BIOTA. *Brookhaven National Lab., Upton, N. Y., Carbon Biosphere, Proc. Brookhaven Symp. Biol., 24th, Upton, N. Y., 1972, p. 159-181, Aug. 1973. 45 refs. (May 16-18.)*

NTIS: CONF 720510

The atmospheric sulfur cycle is reviewed with emphasis on its connections to the biota. Biometeorological factors affecting rates of uptake of sulfur dioxide by vegetation, the use of regional atmospheric pollution models to predict acidity in precipitation, and factors affecting emission of biogenic sulfur compounds into the atmosphere are discussed. Sulfur occurs in the atmosphere principally as hydrogen sulfide, SO2, and sulfates originating respectively, from the nonspecific reduction of organic sulfur and sulfate reduction by anaerobic bacteria; from oxidation of H2S, combustion of fossil fuels, and volcanic action; and from sea spray and oxidation of H2S or SO2. The global atmospheric sulfur budget totals 183 times 10 to the 6th power tons/yr from human activity, biogenic H2S, and sea spray sulfate. Sinks include precipitation, dry deposition, absorption of SO2 by vegetation and soils, and absorption of SO2 by oceans. Sulfur dioxide absorption by vegetation and soils, sulfate removal by precipitation scavenging, and the emission of biogenic H2S are discussed in detail.

35217 APTIC NO. 58191

Irie, Takahisa, Susumu Yoshizawa, and Shinichiro Ozeo

CHARACTERISTICS OF POLLUTANTS DISPERSION WITHIN CHANNEL SPACE (II). *(Kojo kukan nai no osen kakusan no seijo ni tsuite (2)). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 8(3):390, Oct. 1973. (Presented at the Japan. Society of Air Pollution, Annual Meeting, 14th, Fukushima, Japan, Nov. 6-8, 1973, Paper 129.)*

A pollution dispersion test was conducted in a channel space as a followup study of similar previous experiments. Wind tunnels were used, and the dispersion characteristics in channel like space were examined. The wind tunnels were 100 m wide, and 50, 100, and 200 m deep; carbon dioxide was used as the tracer. The measurements were taken at the center cross section of the channel, on the total 25 mm lattice plane, using the Beckman Infrared Analyzer. The ventilation frequencies were compared for the momentary uniform dispersion and divided circulations (into four sections). A dispersion formula was obtained.

35218 APTIC NO. 58123

Ishizaka, Yutaka

ON MATERIALS OF SOLID PARTICLES CONTAINED IN SNOW AND RAIN WATER: PART 2. *J. Meteorol. Soc. Japan, 51(5):325-336, Oct. 1973. 6 refs.*

Samples of snow and rain water were collected at a site on the coast of the Hokuriku district on Feb. and March 1970. Quantitative analysis of minerals in the solid particles contained in each sample was carried out by x-ray diffraction. The main source regions of these particles were inferred from the analyses of the mineral composition of the solid particles and trajectories of air masses. Most of the solid particles in snow were soil particles blown up from the upper drainage basin of Yellow River, China (Loess particles). The origin of the solid particles in sleet was very similar to that of the solid particles in snow. Most of the mineral particles in rain were soil particles from the upper drainage basin of Yangtze River, China. (Author abstract)

35219 APTIC NO. 58174

Koike, Kazumi, Ichiro Kojima, Junichiro Takeuchi, and Kimiyoshi Sato

PHOTOCHEMICAL SMOG FORECASTING PROGRAM. *(Taiki osen yosoku shisutemu). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 8(3):293, Oct. 1973. (Presented at the Japan. Society for Air Pollution, Annual Meeting, 14th, Fukushima, Japan, Nov. 6-8, 1973, Paper 44.)*

In Aichi prefecture, a photochemical smog forecasting system is being developed based on data received by a computer monitoring system. Information on the wind velocity, direction, temperature, humidity are sent every 20 min from 51 stations in the prefecture, and every hour from 16 stations in Nagoya. The weather conditions for a potentially high oxidant level are mobile high pressure belts with a central high, a stagnant front, or a sunny day during or just after the rainy season, and in all cases when the pressure gradient is slow.

When there is a warm current and high pressure in the upper layer (700t850 mb), a temperature higher than 24 C, a temperature higher than 34 C in midsummer, much sun, intermittent sunniness and cloudiness, cloudiness, or when the wind velocity is less than 3 mph, a high oxidant concentration may be expected.

35220 **APTIC NO. 55718**

Mammarella, L.

THE CHARACTERISTICS OF URBAN AIR POLLUTION. *(La caratterizzazione dell inquinamento atmosferico urbano). Text in Italian. Inquinamento, 15(5):27-33, June 1973. 42 refs.*

The character of air pollution in urban areas is governed principally by two groups of factors, those relating to the local microclimate and atmospheric stability, and the sampling mode of the most representative pollutants. An urban environment differs from a rural one by a change of topography due to streets and construction and by continuous emission of particulates, gases, and vapors. Compared to rural zones, urban areas have 10 times the level of particulates, five times the sulfur dioxide, 10 times the carbon dioxide, and 25 times the carbon monoxide. In rural areas compared to urban ones, insolation is higher by 15-20%, nebulosity by 5-10% precipitation by 5-10%, median annual temperature is lower by 1 to 1.5 F, relative humidity is higher by 6%, and wind velocity is higher by 20-30%. Urban centers constitute islands of heat where temperature declines slower at night, and minimal temperatures are consequently higher than in rural areas. Characterization of an urban environment must be based on data variating temperature, wind velocity, relative humidity at ground level, levels and size of particulates, and concentrations of SO2, NOx, CO2, CO, spores, pollen, and microorganisms at 2 m above ground level. Mathematical modelling requires a diffusion study by means of tracers and the determination of the emission-immission ratio of pollutants from the pollutant content of fuel quantities consumed and the pollution levels actually measured at ground level. Monitoring of particulates can be accomplished by deposimeters or by filters; biological aerosols are monitored by the use of a Hirst trap.

35221 **APTIC NO. 58150**

Meszaros, E.

EVIDENCE OF THE ROLE OF INDIRECT PHOTOCHEMICAL PROCESSES IN THE FORMATION OF ATMOSPHERIC SULPHATE PARTICULATE. *J. Aerosol Sci., 4(6):429-434, 1973. 15 refs.*

The mass concentration of atmospheric sulfate particles was determined during daylight for relatively short time intervals. Characteristics of atmospheric aerosols and trace gases (sulfur dioxide, nitrogen oxides, and ammonia) and some meteorological parameters were measured simultaneously. In summertime, the SO4 concentration and the logarithm of the mole ratio of SO4 to SO2 correlated well with the intensity of solar radiation in wavelengths of 0.29-0.50 micron and with the temperature. Apparently, SO4 particle formation is activated by some primary photochemical reaction followed by secondary thermal processes. (Author abstract)

35222 **APTIC NO. 58122**

Morita, Yashuhiro, Haruji Ishikawa, Jiro Nagasaka, and Masahiro Kanada

THE LAND-TO-OCEAN TRANSITIONAL BEHAVIOR OF THE ATMOSPHERIC ELECTRIC PARAMETERS AND THEIR RELATION TO ATMOSPHERIC POLLUTION. *J. Meteorol. Soc. Japan, 51(5):294-306, Oct. 1973. 24 refs.*

The factors controlling the land-to-ocean transitional behavior of electric parameters including condensation nucleus concentration were interpreted from data obtained from nine expeditions over the Pacific Ocean and the East China Sea. Even though, in some cases, the conductivity and nucleus concentration showed systematic dependence on distance from shore, the age of the relevant air masses is the principal factor that controls the electrical state of the atmosphere over the oceans. The distribution of nucleus concentration, which may be highly irregular over land, tends to become uniform with time polluted air masses extend gradually over the oceans. The influence of air masses more than about 60 hours old on the conductivity and nucleus concentration seems to be very small. The variation of the equivalent radius with the age of air masses promises to be of importance in understanding the physics of the various processes which seem to control the nucleus concentration and its dependence on the distance from shore.

35223 **APTIC NO. 58245**

Reiners, William A.

A SUMMARY OF THE WORLD CARBON CYCLE AND RECOMMENDATIONS FOR CRITICAL RESEARCH. APPENDIX. *Brookhaven National Lab., Upton, N. Y., Carbon Biosphere, Proc. Brookhaven Symp. Biol., 24th, Upton, N. Y., 1972, p. 368-382, Aug. 1973. 24 refs. (May 16-18.)*

NTIS: CONF 720510

The carbon cycle is divided into four large areas -- the atmosphere, land surfaces, ocean waters, and sediments -- which in turn can be subdivided into constituent pools. In general, the larger the area, the slower its rate of turnover. While the extent of control that one area exerts over the cycle may increase with increasing area size, the response time of these areas as buffering agents is approximately the inverse of size. Marine solution and sedimentation are probably the master controls of the cycle in the long term. The steady state of the cycle is being disturbed by fossil fuel combustion which has increased carbon dioxide in the atmosphere. Accelerated forest cutting, burning, decomposition of soil organics, and erosion are reducing pools of carbon on land. Eutrophication may be increasing organic pools in coastal and fresh waters. Man s activities are increasing rates of rock weathering. Critical research topics should cover the increase of CO2 in the atmosphere, the dilution of carbon-14 by fossil fuel injection (Suess effect), the increase of trace gases (such as hydrogen, methane, carbon monoxide, nitrous oxide, and ozone) in the atmosphere, monitoring of trace gases and CO2, the ocean as a sink for excess atmospheric CO2 (including studies of the surface layer, the deep layer, sedimentation, and eutrophication), photosynthetic responses to CO2 enrichment, environmental toxification due to air pollution, detritus pools, influences of land use on the biomass, and modeling as a theoretical basis for studying the environment.

35224 **APTIC NO. 56077**

Schmidt-Burbach, Gerhard M.

CLIMATIC CHANGES IN URBAN AREAS. *(Klimaaenderung im urbanen Bereich). Text in German. Tech. Umweltmag., no. 4:20-24, Sept. 1973. 18 refs.*

A consideration of the world-wide rising atmospheric carbon dioxide level as well as of the water vapor concentration shows that the real impact on the climate is difficult to assess. While the rise of the CO2 level brings a temperature increase in its wake, the increasing water vapor concentration manifesting itself in form of fog and clouds has the opposite effect. The rising aerosol concentration is not only responsible for the condensation of water vapor and the scattering of light back into space but also for absorbing radiation and thus warming the air. To date the numerous possible effects of air pollution on the average world temperature have not changed it significantly. Apart from the mentioned counteracting effects caused by various air pollutants, the natural climatic fluctuations are so large that smaller deviations do not become apparent. A discussion of the effects of pollution by airplanes reveals that it is generally feared that through reaction between the emitted oxides of nitrogen and the ozone in the stratosphere which reduces the latter to oxygen, the ozone shield will eventually be affected. A thinner ozone shield would become permeable for ultraviolet radiation below 300 nm. Contrary to the global climate, the urban microclimates have experienced marked changes. The largest contribution to the higher average temperatures measured in cities today comes from the waste heat liberated from combustion processes. The high pollution by particulate matter over cities has reduced solar radiation and increased fog and cloud formation.

35225 APTIC NO. 58135

Skibin, D.

COMMENT ON WATER POLLUTION IN LAKE MICHIGAN FROM POLLUTION AEROSOL FALLOUT. *Water, Air, Soil Pollut., 2(4):404-407, Dec. 1973. 10 refs.*

The hypothesis that air pollution is a major source of some water pollution by trace elements in Lake Michigan was studied. Hazard evaluation techniques were used to assess the overall transfer efficiency of pollution from the air to the lake. This efficiency was at least 25%, which supports the hypothesis. The problem should be studied taking into account local mesoscale systems (such as lake breeze) and the distribution of air trajectory, wind speed, and stability categories. (Author abstract)

35226 APTIC NO. 57889

Soo, S. L.

DIFFUSION AND FALLOUT OF POLLUTANTS EMITTED BY AIRCRAFT ENGINES. *In: Engine Emissions. Pollutant Formation and Measurement. George S. Springer and Donald J. Patterson (eds.), New York, Plenum Press, 1973, Chapt. 7, p. 267-289. 22 refs.*

The usually identified pollutants from aircraft engines are particulates, nitric oxide, hydrocarbons, carbon monoxide, and sulfur dioxide. Soot, HC, and CO arise from incomplete combustion and may be reduced by engine design improvements including higher combustion temperatures. However, reduction of these components through temperature increases tends to increase NO formation as long as air is used as an oxidant. Thus, trade-offs in design occur. Sulfur dioxide originates from sulfur in the fuel and can be reduced by reducing fuel sulfur content. In treating diffusion and fallout, it is reasonable to focus on particulates (soot) and NO as typical species since they are the most difficult emissions to control and their dispersion characteristics (gas-solid) are quite different. Other species are more susceptible to correction by engineering design and fuel technology. Sources of pollutant emissions are identified, and amounts of the various pollutants from different types of aircraft engines are described. Theoretical analyses are given of diffusion and fallout, of chemical and physical conversions, of plume behavior from a stack, of plume paths from aircraft, of wing-tip vortices, and of plume visibility.

35227 APTIC NO. 56067

Tiwari, V. S. and C. R. Sreedharan

OZONE CONCENTRATION STUDIES AND OZONE FLUX MEASUREMENTS NEAR THE GROUND AT POONA. *Pure Appl. Geophys. (Basel), vol. 106-108:1124-1138, 1973. 13 refs.*

Using a modified Brewer bubbler ozone sensor, continuous measurements of the ozone concentration near the ground were made at Poona during the year 1969-1970. The surface ozone concentration showed a pronounced seasonal variation, with a minimum during the monsoon months and a maximum during the premonsoon summer months. There was also a marked diurnal variation in the surface ozone concentration which clearly followed the diurnal variation in temperature; it also showed a maximum during the summer months and a minimum during the monsoon. A secondary maximum in ozone concentration occurred in the forenoon during the winter months, associated with the temperature inversions that occur near the ground during this season. Both ozone and radioactive tracers such as Cs-137 (in both air and precipitation) showed variations indicating that they had identical source regions and sinks. The latitudinal anomaly of surface ozone and Cs-137 observed in the low latitudes of India arises from the reduction in the rate of transfer of these tracers from the stratosphere to the troposphere as a result of the reversed circulation at the upper levels at this time. From continuous measurements of surface ozone made with three electrochemical sensors exposed at 0, 15, and 35 m above the ground, the ozone flux was directly calculated for the first time in the tropics. The ozone flux was calculated using both the rate of decay method and Regener s profile method. The profile method gave values on the order of 1.71 to 7.04 times 10 to the 11th power mol/sq cm/sec, while the decay method gave values from 4.2 to 5.6 times 10 to the 11th power mol/sq cm/sec; these values are in good agreement with the flux values reported by other investigators. (Author abstract)

35228 APTIC NO. 58217

Uthe, Edward E. and Philip B. Russell

EXPERIMENTAL STUDY OF THE URBAN AEROSOL STRUCTURE AND ITS RELATION TO URBAN CLIMATE MODIFICATION. *Preprint, Stanford Research Inst., Menlo Park, Calif., 20p., Nov. 2, 1973. 23 refs.*

Observations of urban aerosols using active and passive remote sensors, as well as in-situ instruments, were conducted during 1971, 1972, and 1973 METROMEX field programs. Urban mixing depth was observed by lidar and acoustic sounder; urban-rural differences in mixing depth, cloud development, and temperature were studied by mobile lidar; and particulate optical depth and size distribution were studied by multiwavelength sun photometer. Plans for future research are briefly indicated. These results were used to study the effect of particles on precipitation and radiative transfer. The development and application of indirect sounding techniques were used to derive a quantitative description of atmospheric structure with high spatial and temporal resolution over extended time periods. (Author abstract modified)

35229 APTIC NO. 58145

Yamamoto, S. and O. Yokoyama

DIFFUSION MODEL OF PHOTOCHEMICAL SMOG. *(Kokagaku sumoggu no kakusan moderu). Text in Japanese. Kogai (Pollution Control), 8(5):20-28, Sept. 1973. 27 refs.*

A model of photochemical smog was developed using photochemical equations among nitrogen oxides, hydrocarbons, and oxidants, a diffusion equation, and an equation of extinction of ultraviolet rays. Distance and height of the high concentration region were investigated. The maximum concentration of oxidant appeared between 200 and 300 m from the surface. There was a high concentration region between 10 and 15 km from the seashore. This region moves leeward with the same speed as the sea breezes. These results were consistent with some observations taken in the Tokyo area.

1972

35230 APTIC NO. 58240

Bacastow, Robert and Charles D. Keeling

ATMOSPHERIC CARBON DIOXIDE AND RADIOCARBON IN THE NATURAL CARBON CYCLE: II. CHANGES FROM A. D. 1700 TO 2070 AS DEDUCED FROM A GEOCHEMICAL MODEL. *Brookhaven National Lab., Upton, N. Y., Carbon Biosphere, Proc. Brookhaven Symp. Biol., 24th, Upton, N. Y., 1972, p. 86-135, Aug. 1973. 47 refs. (May 16-18.)*

NTIS: CONF 720510

A nonlinear geochemical model of the interaction of atmospheric carbon dioxide with the oceans and land biota was constructed to predict future changes in atmospheric CO2 concentrations. If production of CO2 from fossil fuels continues, the perturbations from preindustrial times may become so large that a linear model is unrealistic, especially because it fails to take into account that ocean surface water will become progressively more acid and less able to absorb each new increment of industrial CO2. On the assumption that industrial CO2 production continues to increase at the rate of the past 20 years and that the ultimate increase in biomass on the land biota is no more than twice the present biomass, the atmospheric CO2 concentration will reach a value six to eight times the preindustrial value in 100 years. When the radiocarbon (carbon-14) concentration in dated wood and the recent atmospheric increase in CO2 are compared in the context of the model, it appears that the land biomass has increased 1-3% since the beginning of the industrial era. This calculation considers the actual year to year variations in industrial CO2 production and the heliomagnetic variation in radiocarbon production in the stratosphere. The inferred biomass increase, due to CO2 fertilization, is too small to be verified by direct observation and is not established. On the other hand, the trend in atmospheric CO2 apparently rules out any large recent change in biomass. (Author abstract)

35231 **APTIC NO. 58241**

Cadle, Richard D.

ATMOSPHERIC CARBON MONOXIDE. *Brookhaven National Lab., Upton, N. Y., Carbon Biosphere, Proc. Brookhaven Symp. Biol., 24th, Upton, N. Y., 1972, p. 136-143, Aug. 1973. 24 refs. (May 16-18.)*

NTIS: CONF 720510

Properties, sources, concentrations, and sinks of carbon monoxide are reviewed. Carbon monoxide is a colorless, odorless gas produced principally by combustion of organic substances. It is probably also produced by bacterial action on land and in the oceans. Concentrations is the natural troposphere average 0.1-0.2 ppm by volume. In smoggy city air, 40 ppmv is common. The mechanisms of removal of CO from the atmosphere are not well known, but seem to include chemical reactions in both the troposphere and stratosphere and bacterial action at the Earth s surface. (Author abstract modified)

35232 **APTIC NO. 58254**

Darling, Eugene M., Jr.

COMPUTER MODELING OF TRANSPORTATION-GENERATED AIR POLLUTION -- A STATE-OF-THE-ART SURVEY (FINAL REPORT). *Dept. of Transportation, Cambridge, Mass., Transportation Systems Center, Contract OS-222, Rept. DOT-TSC-OST-72-20, 125p., June 1972. 44 refs.*

NTIS: PB-213013

The state-of-the-art of air pollution modeling with particular emphasis on the modeling of dispersion from transportation sources is surveyed. Models which have actually been implemented are stressed and the computational aspects of these models are treated in detail. Applications are discussed and validations are critically assessed. Gaussian and conservation of mass models are currently the most widely used tools for analyzing the dispersion of pollutants in the atmosphere. Models presently in operation are run on medium to large-scale computers of the IBM 360/50 class or greater and nearly all of these models are programmed in FORTRAN IV. Although existing models have been applied to a wide variety of air pollution problems, their performance has not been adequately evaluated. This deficiency is primarily due to the fact that, until recently, instrumented transportation test sites have not existed and hence very little validation data have heretofore been generated. However, such test sites do now exist and data from them is beginning to become available, hence the validation of dispersion models will soon be feasible. (Author abstract)

35233 **APTIC NO. 58239**

Ekdahl, Carl A. and Charles D. Keeling

ATMOSPHERIC CARBON DIOXIDE AND RADIOCARBON IN THE NATURAL CARBON CYCLE: I. QUANTITATIVE DEDUCTIONS FROM RECORDS AT MAUNA LOA OBSERVATORY AND AT THE SOUTH POLE. *Brookhaven National Lab., Upton, N. Y., Carbon Biosphere, Proc. Brookhaven Symp. Biol., 24th, Upton, N. Y., 1972, p. 51-85, Aug. 1973. 28 refs. (May 16-18.)*

NTIS: CONF 720510

Atmospheric measurements of carbon dioxide at the Mauna Loa observatory in Hawaii and a the South Pole and the strategy for interpreting the atmospheric CO2 record are discussed. The CO2 concentrations increased by 6.8 ppm in the Northern Hemisphere and by 6.7 ppm in the Southern Hemisphere from 1959 to 1969. These increases corresponded to 2.34% of the preindustrial CO2 concentration of 290 ppm. They implied that approximately 49% of the contemporary production of CO2 from fossil fuel combustion and limestone kilning remained airborne. The 51% not remaining airborne was absorbed by the oceans and land biota. The atmospheric radiocarbon (carbon-14) variations as recorded by tree rings were used to learn more about this uptake. A series of geochemical models of the reservoirs and sinks into which CO2 and C-14 can mix were studied. The character of these models was established by evaluating an analytically derived atmospheric transfer function for a wide range of linear model parameters. For a purely oscillatory C-14 source, this function gave the attenuation and phase shift of C(14)O2 in the lower atmosphere; for a purely exponentially increasing CO2 source, it gave the fraction of CO2 remaining airborne or in the lower atmosphere. The source was assumed to have operated until initial transient variations died out. For reasonable reservoir sizes and transfer times, the stratospheric variation in C(14)O2, estimated from direct observations of cosmic rays and sunspot numbers, is strongly attenuated in the lower atmosphere; the predicted airborne fraction agrees with the earlier implied value of 49% (42% for the lower atmosphere) only if the carbon pool of the land biota grows appreciably. These models with nonlinear corrections were used to predict year-by-year simultaneous variations in atmospheric CO2 and C(14)O2. (Author abstract modified)

35234 **APTIC NO. 55233**

Garratt, J. R. and G. I. Pearman

ATMOSPHERIC CARBON DIOXIDE. *Clean Air Society of Australia and New Zealand, Proc. Int. Clean Air Conf., Melbourne, Australia, 1972, p. 17-22. 34 refs. (May 15-18.)*

Important sources and sinks of atmospheric carbon dioxide are described, and the carbon cycle is represented as a set of interacting reservoirs. Exchange rates between the main active reservoirs, viz., the atmosphere, surface ocean layer, and terrestrial biosphere are considered, and turnover times of CO2 molecules in each reservoir are deduced and compared with independent measurements. Measurements of atmospheric CO2 concentration indicate an increase in the presence of an increasing annual CO2 output from combustion of fossil fuels. The oceans appear to be an important sink for this CO2 excess, though they are capable of significant inputs of CO2 to the atmosphere, possibly over periods of decades. Recent studies on the climatic consequences of an increased CO2 content in the atmosphere indicate a small temperature increase for a doubling of CO2 concentration, but possible feedback effects are excluded. Further changes in the concentration of other atmospheric constituents could produce comparable absolute temperature changes of either sign. (Author conclusions modified)

35235 **APTIC NO. 58238**

Machta, Lester

PREDICTION OF CO2 IN THE ATMOSPHERE. *Brookhaven National Lab., Upton, N. Y., Carbon Biosphere,* *Proc. Brookhaven Symp. Biol., 24th, Upton, N. Y., 1972, p. 21r31, Aug. 1973. 11 refs. (May 16-18.)*

NTIS: CONF 720510

Predictions of future and past carbon dioxide concentrations were derived from a simple multireservoir exchange model considering the stratosphere, troposphere; mixed layer of the ocean, deep ocean; short-term land biosphere, long-term land biosphere, and marine biosphere. All exchanges are prescribed from literature or personal estimates except the trosphere-mixed ocean layer that is obtained from a trial-and-error procedure using carbon(14) dioxide as a tracer. On the basis of reasonable estimates of growth in the use of fossil fuel, the atmospheric CO2 content predicted for the year 2000 is about 385 ppm, compared to about 320 ppm at present. The uncertainties in the model are probably less significant using the above-mentioned procedure than the assumption that the oceans and biosphere will continue to behave in the future as in the 1960s. The so-called greenhouse effect, using a simplified one-dimensional (vertical) model of the atmosphere, calls for about 0.5 C warming from the increase of CO2 to 385 ppm. This estimate of 0.5 C is on even shakier ground than the forecast of future CO2 concentrations. (Author abstract modified)

35236 APTIC NO. 57922

Munn, R. E., A. E. J. Eggleton, L. Facy, D. H. Pack, and F. H. Schmidt

DISPERSION AND FORECASTING OF AIR POLLUTION. *World Meteorological Organization, Geneva, Switzerland, Commission for Atmospheric Sciences Working Group on Atmospheric Pollution and Atmospheric Chemistry, Technical Note 121, Rept. 319, 116p., 1972. 371 refs.*

Progress in the state of the art of dispersion theory and practice is outlined. The height to which a buoyant plume will rise is discussed. The theoretical considerations are briefly outlined and a number of empirical formulae presented, with a discussion of how to use the formulae successfully. The classical expression for diffusion is discussed as it relates to transport and diffusion in non-urban environments. Simplifications of this expression as it applies to moderate travel distances during steady-state conditions are then presented. Complications caused by mesoscale or synoptic-scale systems and travel over long distances are then considered. Some pollutants undergo chemical reactions or are removed by precipitation--these processes are reviewed as far as known. The surface of the earth acts as a sink and sometimes (i.e., during duststorms) as a source. The effect of cities on the transport and dispersion of pollutants is also reviewed. After a review of the urban microclimate, models for various types of sources are presented. Finally chemical reactions and removal processes over cities are discussed. The forecast aspect of meteorological services for air pollution abatement are then treated. The observations required and the forecast parameters are reviewed. Forecasting of air pollution potential is then described, followed by a discussion of forecast verification. Finally the more difficult problem of forecasting the concentration of the pollution itself is examined. An appendix contains a detailed description of atmospheric diffusion investigations in the U.S.S.R. (Author summary)

1971

35237 APTIC NO. 55506

Brazell, J. H.

WEATHER AND THE CLEAN AIR ACT. *Preprint, National Society for Clean Air, Brighton, England, p. 56-64, 1971. 11 refs. (Presented at the National Society for Clean Air Conference, Folkestone, England, Nov. 2-5, 1971.)*

Recent work on the comparison visibility and the frequency of fog at several places before and after smoke control are reviewed. There was a dramatic reduction in the frequency of fog in central London and later at London (Heathrow) Airport. Smoke control commebced earlier and progressed faster in central London than it did near the airport. Similar improvements were observed at Manchester, Glasgow, and the West Riding of Yorkshire. There was a decline in fog frequency at many rural and urban sites. Average winter sunshine in centrl London during the decade 1958-1967 was substantially greater than the long term average, but there was no such increase in rural sites outside London. The evidence clearly indicates that these improvements in weather are associated with voluntary or enforced smoke abatement, and that the Clean Air Act has played a big part in the dramatic improvement in certain towns and cities. (Author summary modified)

35238 APTIC NO. 58263

Changnon, Stanley A., Jr.

LESSONS FROM THE LA PORTE ANOMALY. *Australian Academy of Science and American Meteorological Society, Boston, Mass., Int. Conf. Weather Modification Proc., Canberra, Australia, 1971, p. 193-198. 15 refs. (Sept. 6-11.)*

The evidence of the reality of the LaPorte anomaly continues to mount to a point that detractors, especially those using very restricted data, cannot refute it. Corroborating data in the form of runoff increases in rivers at LaPorte, correlation of LaPorte rainfall with local tree rings, local corn yield increases, and increases in crop-hail losses all clearly demonstrate the reality of the anomaly. However, it has taken time for this analysis to occur; it has required the interest of the scientific community; and finally, many publications have been issued to bring all the results forward. Even with the extensive analysis of all historical data and the corroborating results, the problem of inadvertent precipitation modification is of sufficient significance and difficulty to require an extensive field investigation to define specifically how, when, and where a major urban-industrial complex can alter precipitation. Such a program, METROMEX, has begun in 1971 at St. Louis, and urban-related aerosols, thermal effects, and moisture reach convective clouds on summer days. (Author conclusions)

35239 APTIC NO. 58072

Deniau, R. and P. Mery

ESTIMATION METHODS OF DISPERSION OF GASEOUS POLLUTANTS DOWNWIND INDUSTRIAL STACKS. *North Atlantic Treaty Organization, Committee on the Challenges of Modern Society, Proc. Expert Panel Air Pollut. Modeling, 2nd Meet., Paris, France, 1971, p. III-1-III-82. 59 refs.*

Estimation methods for the dispersion of gaseous pollutants downwind from industrial stacks are presented. Considerations examined include: main parameters in the dispersion of pollutants from an isolated stack, e.g., effluent characteristics at the chimney exit, meteorological parameters, and characteristics of the surrounding buildings and topography; the use and limits of formulas for the rise of a plume and plume diffusion from a point source; more elaborate methods for the estimation of pollution downwind from an isolated stack; and conditions of similitude and modeling facilities involved in scale-model experiments. An adding process may be used in order to extend the methods covered to multi-source problems when there is no aerodynamical interaction between the different sources (e.g., in-line stacks).

35240 APTIC NO. 58264

Drummond, A. J. and J. R. Hickey

LARGE-SCALE REFLECTION AND ABSORPTION OF SOLAR RADIATION BY CLOUDS AS INFLUENCING EARTH RADIATION BUDGETS: NEW AIRCRAFT MEASUREMENTS. *Australian Academy of Science and American Meteorological Society, Boston, Mass., Int. Conf. Weather Modification Proc., Canberra, Australia, 1971, p. 267-276. 15 refs. (Sept. 6-11.)*

The CV-990 jet aircraft cloud research facility is described and radiation measurements made from it are compared to previous measurements. Ony reason for the Drummond-Hickey cloud albedos (except in the case of cirrus) being significantly lower than those reported by Robinson and London is possibly the much higher values of the solar elevation. Also, the fast sampling rate of the CV 990 measurements enabled a more general scanning of the cloud layers to be obtained and this, in combination with the prevalent high solar elevations, would certainly aid in preventing the over-emphasizing of localized strong cloud reflections not typical of horizontally extended layers, therefore yielding more representative results for large-scale cloud studies. Evaluation of the absorption of short-wave radiation by cloud formations is difficult if only single-aircraft measurements are available. However, the initial values derived in the current investigation are in good agreement with similar data previously established by the same means. An important outcome of this part of the program is the evidence for large attenuation of the direct solar radiation (through scattering, reflection, and absorption) by dense cirroform layers associated with strong vertical development of cumulonimbus cloud in the velocity of the Intertropical Convergence Zone.

35241 **APTIC NO. 58247**

Fortak, Heinz

MATHEMATICAL-METEOROLOGICAL MODELING OF AIR QUALITY IN THE UNTERMAIN REGION (FRANKFURT). *North Atlantic Treaty Organization Committee on the Challenges of Modern Society Proc. Expert Panel Air Pollut. Modeling, 2nd Meet., Paris, France, 1971, p. V-1-V-8. (July 26-27.)*

The present status and future plans for a mathematical-meteorological model of air quality in the Untermain Region (Frankfurt) are presented. Development of emission climatology for the first phase of the model strategy is based on the following four models: a model of Bremen for homogenous, topographically undisturbed wind conditions; a diffusion model for meso and/or submeso-scale wind systems in which divergent and/or convergent flow conditions are considered; a diffusion model for weather situations with weak gradient and small eddy flux; and a diffusion model for topographically influenced flow and diffusion conditions. Development of models for sensitivity studies will be particularly important in the second phase of the project, while the influence of the surface topography on the formation of the flow and diffusion conditions will be examined in a third phase. Finally, weather situations (hourly values) will have to be classified in such a way that there will be no doubt which section of the model has to be used.

35242 **APTIC NO. 58116**

Horie, Y. and L. T. Fan

MACROSCOPIC MODEL OF URBAN AIR POLLUTION. *Environ. Letters, 2(1):1-12, 1971. 22 refs.*

Derivation of a macroscopic model of urban air pollution starting from the fundamental equations of fluid dynamics, viz., the equation of change and macroscopic material balance, is presented. The resulting first order differential equation characterizes the dynamic behavior of a regional average pollution level, and the assumptions required for the derivation are that source distribution and horizontal concentration distribution within the region are homogeneous and that vertical distributions of wind and concentration are known. Effects of wind speed, wind direction, eddy diffusivity, city size, and mixing depth of the atmosphere on urban air pollution are all taken into account in the simple working equation. The mass of the urban atmosphere is expressed by a simple box in which the emission sources and ground level concentrations are homogeneously distributed. The box is bounded horizontally by the effective boundary of the city (or part of the city) and is bounded vertically by the ground area of the city and by the top of the so-called mixing layer. The model is extremely simple and should be useful for short term prediction of urban air pollution. The adaptive prediction and control scheme of urban air pollution can be developed based on the model.

35243 **APTIC NO. 58261**

Hoy, Richard D.

THE CONTRIBUTION OF THE ATMOSPHERIC AEROSOL TO LONGWAVE RADIATION TRANSFER PRIOR TO FOG FORMATION. *Australian Academy of Science and American Meteorological Society, Boston, Mass., Int. Conf. Weather Modification Proc., Canberra, Australia, 1971, p. 277-281. 9 refs. (Sept. 6-11.)*

Aerosol absorption and scattering are examined under changing humidity conditions in three different environments. The values found for a maritime aerosol are an order of magnitude greater than the values found for a low to mid-tropospheric aerosol. Values for a polluted aerosol are of comparable magnitude to absorption by 1 precipitable cm of water vapor. These findings are discussed in relation to radiation balance over oceans, satellite determinations of sea surface temperature, cloud top temperature determination, the formation of urban fogs, and the study of the radiation loss associated with a subsidence inversion.

35244 **APTIC NO. 58260**

Langer, G. and J. Weickmann

DETAILED EVALUATION OF THE NCAR ICE NUCLEUS COUNTER (INITIAL REPORT). *Australian Academy of Science and American Meteorological Society, Boston, Mass., Int. Conf. Weather Modification Proc., Canberra, Australia, 1971, p. 45-50. 9 refs. (Sept. 6-11.)*

Performance date of a properly operating and modified National Center for Atmospheric Research (NCAR) Counter are presented to refute the conclusion that is in principle not suited to quantitative work. The atomizer that provides the cloud condensation nuclei must be made completely of plexiglas. The humidifier must be properly baffled with wet surfaces to saturate as nearly as possible the sample air at room temperature. All foreign material should be removed from the cloud chamber liner, or frost specks may develop, especially near the top. Before starting the counter, all parts should be wetted with glycol; the felt strip on the lid insert must be wetted by hand. If the room temperature is low, the transfer line from the humidifier may have to be heated slightly to prevent water from condensing and dropping into the sensor. The system should be tested to see that no spurious counts are generated by the unit itself. A procedure for this is given. The calibration procedure and results of calibration tests carried out at three altitudes with four counters under climatic conditions from very dry to humid are reported. The criticism that the cloud chamber exposed the nuclei to supersaturations that vary and are too large is shown to be false. Two counters were run in parallel to explore the effect of variations in the glycol defrosting system, the humidifier, atomizer, sampling lines, and sensor systems on the reproducibility of results. Consistent operation was achieved.

35245 **APTIC NO. 58259**

Morton, B. R. and [illegible] L. McGregor

THE DYNAMICS OF CLOUD TOPS. *Australian Academy of Science and American Meteorological Society, Boston, Mass., Int. Conf. Weather Modification, Proc., Canberra, Australia, 1971, p. 149-174. 13 refs. (Sept. 6-11.)*

The dynamic and kinematic entrainment models of cloud behavior are reviewed. Approximate treatments for maintained turbulent jets and plumes have been used for the construction of steady or quasi-steady cloud models. The assumption of self-similarity of cloud flow in these models is not necessarily valid. Much that is relevant to cloud modeling can be learned by studying buoyant thermals, but there are difficulties in bas-ing closed models for clouds on thermal entity models. While it may be possible to represent much of the behavior of an individual cloud tower in buoyant thermal terms, the effective source for each tower thermal and the degree of its interaction with other thermals and with the body of the cloud and clear air below must be established. Calculations of parameters of cloud behavior are made under the assumptions of different models and these often fail to match the measurements made on real clouds. New models of entrainment and experimental results that have implications for entrainment are presented. The requirements for self-similarity of flow are relaxed. Models of vortex entrainment are considered.

35246 **APTIC NO. 58276**

Paltridge, G. W.

GLOBAL CLOUD COVER AND MEAN EARTH TEMPERATURE. *Australian Academy of Science and American Meteorological Society, Boston, Mass., Int. Conf. Weather Modification Proc., Canberra, Australia, 1971, p. 296-299. 10 refs. (Sept. 6-11.)*

Some equations that relate global cloud cover and mean earth temperature to the appropriate atmospheric constants are derived. The global effects of changes in the constants are then estimated from these equations. The parameters involved are the solar constant (solar output), the planetary albedo of the cloud-free portions of the globe, the planetary albedo of those portions which are cloud covered, and the fraction of the solar input absorbed by atmospheric gases. Variation of the solar constant by decreasing the amount of ozone in the upper atmosphere by 20% would increase the earth temperature by 0.1 C. Introduction of 1/10 artificial cloud cover would increase the fractional cloud cover by 0.05 and the temperature by 0.05 C. Alteration of surface albedo has a very small effect. If clouds became thicker and therefore more absorptive and reflective, temperature and latent heat would drop and thereby tend to reduce the cloud thickness. Absorption would have to increase about 50% to give a 0.2 C decrease in temperature.

35247 **APTIC NO. 57804**

Parczewski, Wiedyslaw

WIND COEFFICIENT OF DILUTION OF THE ATMOSPHERIC AIR POLLUTION. *(Wiatrowy wspolczynnik rozcienczania zanieczyszczen atmosfery). Text in Polish. Wiad. Sluzby Hydrol. Meteorol., 7(19):17-25, 1971. 2 refs.*

The idea of total dilution of atmospheric air pollution is discussed with particular attention to wind coefficient of atmospheric pollution which characterizes quantitatively the flow volume of air in optionally chosen layers of the atmosphere. The value of the coefficient in Poland between 18 and 20 deg eastern meridians was calculated up to 300-500 m high and as its diurnal course for the selected localities. In the lower 300 m layer of the atmosphere, the total flow of air during the night is larger than during the day. This enabled the determination of better conditions of diluting the pollution issued during the night by high emission sources.

35248 **APTIC NO. 58265**

Robinson, G. D. and A. J. Drummond

SOME RECENT AIRCRAFT MEASUREMENTS OF THE ABSORPTION AND SCATTERING OF SOLAR RADIATION BY ATMOSPHERIC AEROSOL. *Australian Academy of Science and American Meteorological Society, Boston, Mass., Int. Conf. Weather Modification Proc., Canberra, Australia, 1971, p. 288-295. 10 refs. (Sept. 6-11.)*

Some previous measurements of the absorption and scattering of solar radiation by particles in the atmosphere are discussed; particularly the high observed ratio of absorption to back scatter which is difficult to explain theoretically. Measurements of dowaward and upward solar radiation fluxes at heights between 1000 and 4000 ft on three days during the BOMEX exercise are examined. They imply, in this preliminary treatment, an absorption of 3 to 6% of the radiation which was practically normally incident above that expected from a clean atmosphere, with no corresponding increase in upward scattering.

35249 **APTIC NO. 58548**

Smith, Theodore B.

POLLUTANTS AND CLOUD CONDENSATION PROCESSES. *In: Man s Impact on the Climate. William H. Matthews, William W. Kellogg, G. D. Robinson (eds.), Cambridge, Mass., MIT Press, 1971, Chapt. 32, p. [illegible]. 8 refs. (Also: In: Long-term effects of Air Pollution-A Survey by G. D. Robinson, National Air Pollution Control Administration, p. 25-31).*

The physical processes involved in the nucleation process are discussed, along with the nature and origins of natural cloud nuclei. Globally, only a small percentage of the cloud condensation nuclei (CCN) are man made, although in localized urban the number of artificial nuclei may exceed the natural population. The effectiveness of additional CCN in modifying precipitation processes depends more on their size range and that of the natural population to which they are added than on overall numbers. natural ice nuclei (IN) are not abundant and very few pollutant particulates possess the ice nucleating property. While local IN concentrations may be increased by the exhaust particulates of jet aircraft, the effluent from steel mills, and particulates resulting from the reaction between lead compounds emitted in automobile exhaust gases and iodine vapor, there appear to be no widespread contributions from these sources. Observational evidence of precipitation changes due to the artificial nucleus population is discussed in terms of local and regional effects.

35250 **APTIC NO. 58262**

Twomey, S.

THE INFLUENCE OF ATMOSPHERIC PARTICULATES ON CLOUD AN? PLANETARY ALBEDO. *Australian Academy of Science and American Meteorological Society, Boston, Mass., Int. Conf. Weather Modification Proc., Canberra, Australia, 1971, p. 265-266. 1 ref. (Sept. 6-11.)*

The yearly mass of cloud nuclei cycled through the atmosphere is estimated to be about 500,000 tons/yr. This is very much smaller than the present global mass emission of pollutants into the atmosphere, so there is more than enough man-made material emitted to change the cloud nucleus concentration. On the other hand, observations suggest that cloud nuclei emitted directly by man s activities are a negligible proportion of the total global production of cloud nuclei; however, the main source of cloud nuclei is probably gas reactions in the atmosphere, and man-made gaseous emissions may therefore also play a part. Automatic observations of cloud nuclei have been in progress since Sept. 1968. No increase has been found since then but the period of data is too short to reveal anything less than a gross increase. A large increase in cloud nuclei is found when air is transported from the Port Kembla-Wollongong industrial region to the measurement site. The increase due to this degree of pollution is enough to produce an increase in cloud albedo of more than 10%.

35251 **APTIC NO. 58258**

Vali, Gabor

A THREE-COMPONENT SYSTEM FOR MEASUREMENTS OF ICE NUCLEUS CONCENTRATION. *Australian Academy of Science and American Meteorological Society, Boston, Mass., Int. Conf. Weather Modification, Proc., Canberra, Australia, 1971, p. 36-37. 4 refs. (Sept. 6-11.)*

A mechanistic approach to measurements of precipitation-forming ice nuclei is possible based on the recognition that ice formation in the atmosphere may take place through a number of distinct nucleation processes. It seems reasonable to suggest that these processes are additive. Deposition can be adequately studied with the aerosol captured on a surface. Membrane filtration or depositing of the aerosol onto a solid surface makes it available for activation in a controlled supersaturation environment. A set of measurements are made with different supersaturations over the range of cloud physical interest, and such measurements are made at a number of different temperatures. Freezing upon contact is studied with the aid of an electrostatic precipitator. The activity of the aerosols as contact nuclei can be evaluated by observation of the number of drops that freeze as functions of time and temperature. Freezing by suspended particles is evaluated with the drop-freezing technique. Modeling of precipitation-forming ice nucleation for cloud systems consists of taking the results of the three measurements described above and computing the potential contributions of each of the processes for the actual conditions within the clouds. Supersaturation and temperature determine the contribution made by deposition. Temperature and the rate of transfer of aerosol into the water drops determine the contributions made by the two freezing mechanisms. The competition between the three processes as well as scavenging by ice crystals and consequent removal of the aerosol from further ice-forming potential can also be included in the model.

35252 **APTIC NO. 55250**

Weaver, Edwin A.

CLEAR-AIR-TURBULENCE DETECTION USING LASERS. *NASA Spec. Publ., no. 270:89-100, 1971. 5 refs.*

Clear-air-turbulence (CAT) detection and measuring aboard aircraft using a carbon dioxide laser Doppler system is discussed. Ground tests established that high velocity wind measurements are possible with the CO2 Doppler system. Aerosols appear to concentrate in turbulent regions where CAT has been located; thus, a system that requires backscattering from aerosols should be feasible. Aerosol scattering theories in the lower atmosphere support the design of a CAT detection system using aerosols as air motion tracers. In all cases examined, lasers, the ruby and the CO2, have been the key elements in systems providing the data to support proceeding the design of a breadboard airborne CAT detection system. Feasibility tests of a research unit aboard the NASA Convair 990 aircraft are planned in 1972. This development has been supported by a ground wind measuring program with a CO2 laser Doppler system. There is good agreement with cup anemometer data. Winds of 160 km (100 mi)/hr have been measured. (Author conclusions modified)

1969

35253 **APTIC NO. 59850**

Papet-Lepine, J. and A. Vassy

PRODUCTION OF ATMOSPHERIC OZONE BY SILENT DISCHARGES. *(Production d ozone atmospherique par les decharges silencieuses). Text in French. Ann. Geophys., 25(1):153-155, 1969. 11 refs. (Presented at the Symposium International de l Ozone, 10th Monaco, Sept. 2-7, 1968.)*

The variations of the ozone concentration at ground level and of the electrical phenomena (long and short period) which occur during a thunderstorm were recorded. Comparison of these data show that ozone is produced during the first stage of the development of a storm cell, before electrical discharges (cloud to cloud, or cloud to earth). Silent discharges near the ground level, in the vicinity of the storm, are the most probable factor in ozone production. Ozone production in the cumulonimbus is not excluded, but only by predischarges. (Author abstract modified)

1968

35254 **APTIC NO. 59946**

Budzinski, Karol

THE DETERMINATION OF A RISE IN ATMOSPHERIC CONTAMINATION DUE TO NEW EMISSION SOURCES. *(Ein Beitrag zur Bestimmung der Erhoehung der Verunreinigungsniveaus in atmosphaerischer Luft durch neue Emissionsquellen). Text in German. Z. Meteorol., 20(1-6):29-30, Jan.-June 1968. (Presented at the Technische Meteorologie, Meteorologischen Gesellschaft, East Germany, Sept. 23-24, 1966.)*

A method is proposed for the determination of contaminant concentration at a given location. After computing the emission values for a set of consecutive narrow intervals of possible wind-speeds, one uses the known relative prevalence wind velocity (both speed and direction) at the given location to determine the relative prevalence of contaminant concentrations at that location.

35255 **APTIC NO. 59948**

Cagnetti, Pietro

DETERMINATION OF THE EQUAL-CONCENTRATION CURVES IN THE AIR AROUND A CONTINUOUS RELEASE OF A RADIOACTIVE EFFLUENT, ON THE BASIS OF THE METEOROLOGICAL INFORMATION COLLECTED ON SITE. *Minerva Fisiconucl., 12(4):239-251, Oct.-Dec. 1968. 8 refs.*

An expression is developed for calculating the curves of isoconcentration in the air at ground level due to a prolonged and constant release of a gaseous contaminant where direct recordings of wind velocity and direction are available and the stability category can be evaluated at the same time. Pasquill s formula and dilution graphs are adapted to the expression obtained, previously reduced to the form of suitable summations so that reference can be made to short time intervals. The expression is used to calculate the curves of isoconcentration in the air at ground level at the Casaccia Center for a continuous and constant release of a gaseous radionuclide. The results obtained are critically analyzed and compared with those found with simpler and more commonly used methods. (Author summary modified)

35256 **APTIC NO. 57968**

Ivanov, A. I., G. S. Livshits, V. Y. Pavlov, and Y. A. Teyfel

POLARIZATION OF DAYTIME SKYLIGHT AND ATMOSPHERIC AEROSOL. *Bull. Akad. Sci. USSR Phys. Atmos. Oceans. (English translation from Russian of: Izv. Akad. Nauk SSSR, Fiz. Atmosfery i Okeana), 4(12):719-722, Dec. 1968. 10 refs.*

This possibility of solving direct and inverse problems of daylight polarization in a cloudless sky is discussed. A direct problem involves the calculation of the degree of polarization of scattered light in an atmosphere with known optical parameters; an inverse problem involves determining the physical characteristics of scattered light based on data of polarization measurements. A new method of calculating the polarization of the light of a clear sunlit sky is proposed, taking into account the contribution of the aerosol component of the atmosphere to polarization effects. Based on the proposed method, the degree of skylight polarization is calculated for the ultraviolet and visual regions of the spectrum using various aerosol models. As expected, a consideration of mutual illumination of aerosol and molecular components, and, to a lesser extent, a consideration of the anisotropy of air molecules, led to a decrease of the theoretical values of the degree of polarization and to a better agreement with observational results. Errors in determining the principal parameters necessary in interpreting the polarization measurements of the sky, the nonhomogeneity of the atmosphere and its instability, do not allow any definite conclusions concerning the refractive index of the particles. Apparently, the most promising investigations are in the infrared, where light scattering by aerosol particles acquires a predominant value.

35257 APTIC NO. 58047

Tarrant, R. F., K. C. Lu, C. S. Chen, and W. B. Bollen

NITROGEN CONTENT OF PRECIPITATION IN A COASTAL OREGON FOREST OPENING. *Tellus (Uppsala), 20(3):554-556, 1968. 7 refs.*

The amount of nitrogen brought down in precipitation in the Cascade Head Forest, Oregon, was measured over a 12-month period. Nitrate nitrogen was determined by the phenoldisulfonic method, ammonium by distillation with a phosphate buffer, and organic nitrogen by the Kjeldahl method. A total of 2881 mm of precipitation was collected, and almost all the rain was associated with storms at sea. Very little nitrite or NO3, and no NH4 was found in the precipitation. Of the total N estimated in the precipitation, 87% was in the organic form. No organic N was found during the period of greatest storm activity, and the major source of organic N measured was believed to be from pollen or other airborne organic debris.

35258 APTIC NO. 57866

Wilson, M. J. G.

INDOOR AIR POLLUTION. *Proc. Royal Soc. A, 307(1489):215-221, Oct. 1968. 10 refs.*

Air pollutants were liberated in a laboratory in a concentration of 1 mg/cu m, and the decay of concentration was measured by standard methods during the return to equilibrium. Half-lives corrected for air leakage were as follows: hydrogen chloride 7 min; sulfur dioxide 40 to 60 min; smoke 145 to 300 min. The rate of removal and the equilibrium concentration of SO2 in the test room was controlled mainly by processes at the surface (absorption) rather than by transport. The deposition velocity of sulfur dioxide was about 0.01 cm/s for the room in normal condition and about seven times greater when the room was treated with sodium carbonate.

1967

35259 APTIC NO. 57848

Lowry, W. P.

THE CLIMATE OF THE CITY. *In: Weather and Life. New York, Academic Press, 1967, Chapt. 15, p. 265-279, 293. 12 refs.*

The relationship between temperature and the climate of the city is discussed and compared to rural areas. Urban areas differ physically in five major respects from rural areas: surface materials, shapes of surfaces, heat sources, moisture sources, and air quality. The magnitude of the physical contrast determines the climatic contrasts. A very populous city may have such a suburban sprawl that it blends very gradually into its rural surroundings and the horizontal temperature gradients become very small. Representative values of urban rural contrast are presented for the following weather variables: annual mean temperature, mean winter minimum temperature, solar radiation on horizontal surfaces, ultraviolet radiation, annual and seasonal mean relative humidity, annual mean wind speed, speed of extreme wind gusts, frequency of calms, cloudiness frequency and amount, frequency of fog, total annual precipitation, and days with less than 0.2 in precipitation.

1962

35260 APTIC NO. 55505

Ricker, C. W. and W. F. Wegst, Jr.

ATMOSPHERIC DILUTION OF GASEOUS EFFULENTS FROM THE PHOENIX LABORATORY STACKS. *Michigan Univ., Ann Arbor Michigan Memorial Phoenix Project, Phoenix Memorial Lab. MR-3, 23p., May 1962. 6 refs.*

Atmospheric concentrations of gaseous effluents generated by the Ford Nuclear Reactor and discharged to the atmosphere through a 17-meter stack on top of the Phoenix Memorial Laboratory were studied as part of the preparation of a proposal for operating the reactor at 2 megawatts. The atmospheric dilution expected at locations in the vicinity of the reactor building during various meteorological conditions was calculated. A dilution factor of 16 may be applied to the concentration of gases discharged from the laboratory stack. The use of such a dilution factor predicts that occupied areas around the reactor site will not be subjected to an argon (41) concentration exceeding the non-occupational maximum permissible concentration even with the reactor operating continuously at 2 megawatts and the pneumatic tube system in continuous use.

35261 APTIC NO. 58014

Scorer, R. S. and C. F. Barrett

GASEOUS POLLUTION FROM CHIMNEYS. *Intern. J. Air Water Pollution (London), vol. 6:49-63, Jan.-Feb. 1962. 2 refs.*

The ground level concentration of pollution emitted from a chimney depends on many meteorological factors, and no single formula can be given which is applicable under all conditions. Using the premise that the pollution is spread uniformly between two vertical cones with axes through the chimney and vertices at the chimney top, a formula is derived for pollution concentration, and a table is given from which long term concentrations can be estimated. Corrections for the table which allow for different wind speeds, wind rose, and thermal rises are presented. Pollution in light wind causes natural dilution to become greatly reduced, and the table is subject to error. A light wind tends to propagate stable air in the lower atmosphere which causes retention of the pollutant gases close to their source of emission. The limitations of thy table are discussed with particular attention to surrounding buildings and smog conditions. The effects of building on pollution dispersion are discussed.

BASIC SCIENCE AND TECHNOLOGY

1974

35262 APTIC NO. 58111

Cook, N. J.

ON APPLYING A GENERAL ATMOSPHERIC SIMULATION METHOD TO A PARTICULAR URBAN SITE FOR AD-HOC WIND LOADING OR WIND ENVIRONMENT STUDIES. *Atmos. Environ., 8(1):85-87, Jan. 1974. 7 refs.*

A general atmospheric simulation method was applied to a particular urban site (Bristol, England) for ad-hoc wind loading and wind environment studies. Application of the method for simulating the lower third of the urban adiabatic boundary layer involved establishing a relationship between the relevant meteorological conditions and a reference wind speed in the simulated flow and representing the actual site at model scale in a wind tunnel. The procedure used for ad hoc tests with a 1/250 simulation method was to represent accurately all building with a 250 m radius of the site plus anything additional required to include five blocks or streets upstream of the site. Detailed models were inserted in appropriate positions for elements which were sufficiently different from the rest of the population of the roughness footprint. The maximum useful height of the simulation was about 70 cm, although no maximum limit was required for the downwind extent of the detailed model.

35263 **APTIC NO. 58142**

Kasaoka, S., H. Tsumaki, and T. Kitamura

CATALYTIC REDUCTION OF NITRIC OXIDE WITH HYDROCARBONS.
Intern. Chem. Eng., 14(1):179-184, Jan. 1974. 2 refs.

The reactivities of various hydrocarbons were investigated for the catalytic reduction of nitric oxide. Nitric oxides were almost stoichiometrically converted to nitrogen, carbon dioxide, and water; and hydrocarbons generally exhibited higher activities than carbon monoxide at higher temperatures. Paraffinic hydrocarbons and ethylene, which has the lowest olefinic number, showed rather low activities. Selection of optimum gas concentration and reduction temperature was important for the complete purification of a mixed gas containing nitric oxide, carbon monoxide, and hydrocarbons. (Author conclusions modified)

35264 **APTIC NO. 58168**

Seitz, W. Rudolf and Michael P. Neary

CHEMILUMINESCENCE AND BIOLUMINESCENCE.
Anal. Chem., 46(2):188A- 202A, Feb. 1974. 52 refs.

Reaction schemes and analytical applications are reviewed for the processes of chemiluminescence and bioluminescence. Ozone can be determined either by its chemiluminescent reaction with rhodamine-B absorbed on an activated silica gel surface o/ by its gas-phase reaction with ethylene. The chemiluminescent reaction between nitric oxide and ozone can be used for nitric oxide determinations. The most important analytical applications of flame chemiluminescence have been to determine sulfur and phosphorus by observing the molecular emission that occurs when sulfur and phosphorus compounds are burned in a hydrogen-rich flame. Metal ions that catalyze luminol chemiluminescence include: cobalt, copper, nickel, chromium, iron, and manganese. Oxygen atoms undergo several gas-phase chemiluminescent reactions that can be applied to trace air pollutant analysis for sulfur dioxide and nitric oxide. Bioluminescence finds its main application in the assay of biological compounds of interest.

1973

35265 **APTIC NO. 57912**

Adams, Charles N., Gilbert N. Plass, and George W. Kattawar

THE INFLUENCE OF OZONE AND AEROSOLS ON THE BRIGHTNESS AND COLOR OF THE TWILIGHT ZONE.
Texas A and M Univ., College Station, Tex., Dept. of Physics, National Aeronautics and Space Administration Contract NGR 44-001-117, Rept. 7, NASA-CR-133739, CSCL 04A, 44p., July 15, 1973. 7 refs.

NTIS: N73-29393

The radiance and color of the twilight sky are calculated for single scattered radiation with the use of spherically symmetric models of the earth s atmosphere. Spherical geometry is used throughout the calculations with no plane parallel approximations. Refraction effects are taken into account through fine subdivision of the atmosphere into spherical shells with a fixed index of refraction. Snell s law of refraction is used to calculate a new direction of travel each time a photon traverses the interface between layers. Five different models of the atmosphere were used: a pure molecular scattering atmosphere; molecular atmosphere plus ozone absorption; three models with aerosol concentrations of 1, 3, and 10 times normal together with molecular scattering and ozone absorption. Various observation positions and local viewing angles in the solar plane for wavelengths in the range of 0.40 micron to 0.75 micron are described. (Author abstract)

35266 **APTIC NO. 58187**

Burke, M. F., R. K. Baker, and J. L. Moyers

THE INTERACTION OF SO2 WITH AIRBORNE PARTICULATE MATTER.
J. Chromatographic Sci., vol. 11:575-578, Nov. 1973. 17 refs.

The interaction of sulfur dioxide with atmospheric particulate matter was investigated by using frontal analysis chromatography. Particles were collected from the ambient atmosphere with glass fiber filters and hi-volume samplers and were removed from the filter material and packed as chromatographic columns. The effect of the presence of organic material associated with particulate matter on the adsorption of SO2 was investigated by subjecting the column packings to different thermal pretreatments. The columns were cooled to room temperature after the pretreatment, and a stream of known concentration of SO2 in nitrogen was passed through the column. Both the total amount of SO2 taken up by the column packings and the shape of the chromatographic fronts were used to interpret the differences in the interactions of the SO2 with the thermally treated particles. The results indicated that the interaction was a very strong function of the amount of organic material associated with the particulates and that a significant fraction of the total SO2 taken up (30-40%) was volatilized, indicating that it remained as SO2 on the surface. Only in the case of the cleanest surface was a significantly smaller fraction available for release. Particulate matter in an urban atmosphere would be less efficient in removing SO2 permanently from the atmosphere than particulates found in more isolated regions. (Author abstract modified)

35267 **APTIC NO. 58113**

Calvert, Jack G., Kenneth L. Demerjian, and J. Alistair Kerr

COMPUTER SIMULATION OF THE CHEMISTRY OF A SIMPLE ANALOGUE TO THE SUNLIGHT-IRRADIATED AUTO-EXHAUST POLLUTED ATMOSPHERE.
Environ. Letters, 4(2):123-140, 1973. 10 refs.

Computer simulations were made of the chemistry of a simple analogue to the sunlight-irradiated, auto-exhaust polluted atmosphere: a mixture of 0.075 ppm nitric oxide, 0.025 ppm nitrogen dioxide, 1.5 ppm methane, 10 ppm carbon monoxide, 0.10 ppm trans-2-butene, 0.10 formaldehyde, and 0.06 ppm acetaldehyde in air with a relative humidity of 50% (25 C). The relative importance towards attack on trans-2-butene of the various possible reactive intermediates was calculated as a function of time; and O(3P), O3, HO2, and HO all appeared to be important during some stage of the reaction with trans-2-butene. The relative importance of several possible sources of the HO (or HO2) radicals which initiate the olefin oxidation was examined in considering which reactions triggered the NO to NO2 conversion. The major initial push to oxidize NO and the olefin appeared to come from aldehyde photolyses in the simulated system in which the rate of the nitrous acid-forming reaction was assumed to be zero; while in the system in which HNO2 was formed at an appreciable rate, its presence and subsequent photolysis enhanced the initial rate of the smog-forming reactions, although HONO was not a necessary component of the polluted atmosphere to account for the general features of the smog-forming reactions. (Author abstract modified)

35268 **APTIC NO. 58284**

Carlson, Thomas A. and G. E. McGuire

ANGULAR DISTRIBUTION OF THE PHOTOELECTRON SPECTRUM OF CO2, COS, CS2, N2O, H2O, AND H2S.
J. Electron Spectrosc. Relat. Phenomena, vol. 1:209-217, 1972/1973. [illegible] refs.

The photoelectron spectra of the triatomic molecules carbon dioxide, carbonyl sulfide, nitrous oxide, carbon disulfide, water and hydrogen sulfide have been measured as a function of the angle theta between the direction of the incoming photon and outgoing photoelectron. The photoelectron spectra have been measured with a double-focusing electrostatic electron spectrometer to which has been attached a chamber containing a gas discharge lamp that can be freely rotated. From the dependence of intensity as a function of theta the angular parameter beta was determined for each ionization band observed in the photoelectron spectra. A correlation was noted between the values of beta and the molecular orbitals relative to the contributions of oxygen and sulfur atomic orbitals. Individual beta values were also obtained for most of the vibrational bands seen in the photoelectron spectra. In most cases the vibrational structure showed little or no change in the angular parameter for a given electronic state. In certain cases, however, such as the fourth ionization band in CS2, CO2, and COS, rather sizeable changes in beta were observed for the different vibrational bands. (Author abstract)

35269 **APTIC NO. 58180**

Chang, C. K. and T. G. Traylor

NEIGHBORING GROUP EFFECT IN HEME-CARBON MONOXIDE BONDING. *J. Am. Chem. Soc., 95(25):8475-8477, Dec 12, 1973. 16 refs.*

A series of simple heme compounds, having approximately the same base-to-heme geometry as that in myoglobin, were prepared in an effort to investigate the neighboring group effect in heme-carbon monoxide bonding. A substantial pyridine neighboring group effect in the fifth and sixth positions during carbon monoxide binding, probably important in determining the behavior of five-liganded hemes in proteins such as myoglobin (as well as those of six-liganded hemes in cytochrome c) was found. The effect of distal imidazole upon carbon monoxide binding was also examined, and a resultant twofold increase in binding appeared consistent with the proposed hydrogen bonding between this imidazole and the CO ligand. The fact that the best of the pyridine compounds prepared had a CO binding constant of only about 1/30 that of myoglobin indicated that there are other important attributes of the protein in addition to the neighboring group effect which contribute to carbon monoxide bonding.

35270 **APTIC NO. 58118**

Cox, R. A.

SOME EXPERIMENTAL OBSERVATIONS OF AEROSOL FORMATION IN THE PHOTO- OXIDATION OF SULPHUR DIOXIDE. *J. Aerosol Sci., 4(6):473-483, Nov. 1973. 19 refs.*

The formation of particles in the ultraviolet photolysis of ppm concentrations of sulfur dioxide in pure nitrogen and in N2 oxygen mixtures has been studied in a flow system. Both the number of particles and the mass of the sulfuric acid aerosol produced was determined over a range of SO2 and water vapor concentrations. In the near ultraviolet (lambda equals 290-400 nm) the mass conversion of SO2 to H2SO4 was too small to be measured, but particles were detected on a condensation nucleus counter above a threshold SO2 concentration when the H2SO4 formation rate was sufficient to achieve an appreciable nucleation rate. The number of stable particles formed increased with H2O vapor concentration at a given H2SO4 production rate. These experimental data agree reasonably well with recent theoretical calculations of aerosol nucleation and growth rate in the H2SO4/ H2O system. At short wavelengths (lambda equals 185 nm) a much higher H2SO4 formation rate was achieved. Although nucleation occurred at less than 1% relative humidity the aerosol growth process was slow at low H2O vapor concentrations. A relative humidity of greater than or equal to 30% was required for the incorporation of the bulk of the H2SO4 into the aerosol phase. (Author abstract)

35271 **APTIC NO. 58126**

Gallily, Isaiah

NONE ON THE RATE OF DIFFUSIONAL MASS TRANSFER AT THE SURFACE OF A NONSPHERICAL SOLID PARTICLE. *J. Aerosol Sci., 4(6):457-460, Nov. 1973. 8 refs.*

The problem of diffusional growth and evaporation of solid nonspherical particles is difficult because the shape of the particle at every moment is generally controlled by an intricate play between diffusion in the external medium and migration on the interface. The discussion here is confined to cases of molecular transport at the medium-side of the particle surface. The diffusional situation considered was convective diffusion and a still medium. The effect that the change in the geometric form of a nonspherical particle exerts on the mass transfer at its surface is discussed. The specific model cases of an infinite cylinder and a general ellipsoid are analyzed and expressions for the variation of their dimensions with time derived. The problem of shape stability is pointed out.

35272 **APTIC NO. 57878**

Garvin, David, ed.

CHEMICAL KINETICS DATA SURVEY V. SIXTY-SIX CONTRIBUTED RATE AND PHOTOCHEMICAL DATA EVALUATIONS ON NINETY-FOUR REACTIONS. (INTERIM REPORT). *National Bureau of Standards, Washington, D. C., Institute for Materials Research, Proj. 3160409, NBSIR 73-206, 120p., May 1973. 403 refs.*

The data evaluations contributed to the Climatic Impact Assessment Program chemical kinetics survey during the period Nov. 1972-April 1973 by various kineticists and photochemists are presented. Data are included on reactions of O(1D), O(1S), oxygen (1 delta), CH3ONO, CH3O, CH3O2, H2O2, HO2, sulfur oxide, sulfur dioxide, and the hydrogen-nitrogen-oxygen system. (Author summary modified)

35273 **APTIC NO. 58168**

James, F. Colin, Alistair Kerr, and John P. Simons

DIRECT MEASUREMENT OF THE RATE OF REACTION OF THE METHYL RADICAL WITH SULPHUR DIOXIDE. *J. Chem. Soc., 69(12):2124-2129, 1973. 9 refs.*

The kinetics of the reaction of methyl radical with sulfur dioxide was studied by flash photolysis of azomethane in the presence of sulfur dioxide. Decay of methyl radical concentration was monitored by its absorption at 216.4 nm using a novel split-beam photoelectric method which permitted the period available for monitoring the decay to be almost trebled. The second order rate constant was measured as 1.75 plus or minus 0.25 times 10 to the 8 cu dm/mol sec, independent of the total pressure both in argon and nitrogen over the pressure range 6.65-26.6 kN/sq m (50-200 torr). This value was of the same order as the rate constant for the reaction of methyl radicals with oxygen and confirmed the suggestion that free radical attack on SO2 could contribute significantly to SO2 removal mechanisms and aerosol formation in polluted atmospheres. (Author abstract modified)

35274 **APTIC NO. 58273**

Jefford, Charles W., Andre F. Boschung, Robert M. Moriarty, Christian G. Rimbault, and Mostyn H. Laffer

THE REACTION OF SINGLET OXYGEN WITH ALPHA- AND BETA-PINENES. *Helv. Chim. Acta, 56(6):2649-2659, 1973. 39 refs.*

The reaction of photogenerated singlet oxygen with alpha- and beta-pinenes (mono-olefins) was reexamined during photooxygenations of the pinenes. Alpha-pinene almost exclusively (99.3% yield) furnished trans-3-hydroperoxy-pin-2(10)-ene. However, detectable amounts of the three other possible products were also found, viz., cis-3-hydroperoxypin-2(10)-ene (approximately .8%) and cis and trans-2-hydroperoxypin-3(4)-ene (approximately .04%). Beta-pinene gave 99.9% of 10-hydroperoxypin-2(3)-ene and a trace (.01%) of norpinan-2-one. Rates of reaction and product composition were treated by modal analysis and reflected the operation of steric and stereoelectronic factors in a reactant-like transition state. (Author abstract modified)

35275 **APTIC NO. 57913**

Kattawar, George W., Gilbert N. Plass, and John A. Guinn, Jr.

MONTE CARLO CALCULATIONS OF THE POLARIZATION OF RADIATION IN THE EARTH S ATMOSPHERE-OCEAN SYSTEM. *Texas A and M Univ., College Station, Tex., Dept. of Physics, Office of Naval Research Contract N000-14-68-A-0308-0002, Proj. NR 083036, Rept. 4, 62p., May 1973. 19 refs.*

NTIS, DDC: AD 764022

The degree and direction of polarization, the ellipticity, and the radiance of the radiation at various levels in the atmosphere and ocean are calculated by a Monte Carlo method which includes all orders of multiple scattering. Both Rayleigh scattering by the molecules and Mie scattering by the aerosols as well as molecular and aerosol absorption are included in the model of the atmosphere. Similarly in the ocean both Rayleigh scattering by the water molecules and Mie scattering by the hydrosols as well as absorption by the water molecules and hydrosols are considered. Separate single-scattering phase matrices are calculated from the Mie theory for the aerosols and hydrosols. Both the reflected and refracted rays, as well as rays that undergo total internal reflection, are followed from the ocean surface. The degree and direction of polarization, the ellipticity, the radiance, and the flux are given as functions of the turbidity of the ocean, the solar zenith angle, and the wavelength of the radiation. (Author abstract)

35276 **APTIC NO. 58141**

Lancaster, Brian

STEADY STATE DUST COLLECTION BY DIFFUSION. *Chem. Eng. Sci., 28(12):2264-2265, 1973. 5 refs.*

The collection of dust particles by diffusion mechanisms is examined mathematically. A droplet on which vapor is condensing from a dusty atmosphere is considered, and a temperature gradient is assumed to exist between the atmosphere and the droplet. The results suggest that the particle capture efficiency in a scrubber is dependent on the amount of condensation occurring in the system rather than on the rate at which the condensation occurs.

35277 **APTIC NO. 55937**

Lipina, T. G.

DETERMINATION OF ISOBUTYLMETHACRYLATE, HEPTYL- AND NONYLACRYLATE IN THE AIR. *(Opredeleniye izobutilmetakrilata, geptil- i nonilakrilata v vozdukhe). Text in Russian. Gigiena Truda i Prof. Zabolevaniya, no. 8:56-57, 1973. 3 refs.*

A colorimetric method for the quantitative determination of isobutylmethacrylate, heptylacrylate, and nonylacrylate in the air is described. The gas samples are taken in a vessel containing 75% sulfuric acid for the saponification of the isobutylmethacrylate, heptylacrylate, and nonylacrylate into their respective alcohols. The alcohols are then determined colorimetrically by a condensation reaction with p-dimethylaminobenzaldehyde. The presence of isobutylmethacrylate as well as of nonylacrylate and heptylacrylate is indicated by yellow to orange and cherry color, respectively. The sensitivity of the method for isobutylmethacrylate, heptylacrylate, and nonylacrylate amounts to 1.3; 2.5, and 4 micrograms/ml, respectively. The error of the determination amounts to 1.2 to 25% for concentrations of 4-10 mg/cu m and over.

35278 **APTIC NO. 58157**

Morita, Yoshiro and Masami Takayasu

THE CATALYTIC REDUCTION OF NOX. *(NOx no sesshoku kangen). Text in Japanese. Nenryo Kyokaishi (J. Fuel Soc. Japan Tokyo), 52(558):757-765, Oct. 1973. 21 refs.*

The mechanism of nitrogen oxides reduction, especially that of nitric oxide by carbon monoxide, hydrogen, various catalysts, ammonia, and various hydrocarbons are analyzed. The analyses are based on the published studies of various scientists. The mechanism of catalytic reduction, however, is not the simple mechanism discussed here, and complex, simultaneous reactions are conjectured. The role of oxygen in the NO-CO reduction, NO-H2 reduction, and NO-NH3 reduction is very interesting, and it seems to control the selectivity of catalyst reaction. In the presence of water, the NO elimination temperature drops about 60 F; for NO-H2, in the reduction atmosphere without O2 at the temperature 550 F, NO almost completely reduces into NH3. When O2 is added, the formation of NH3 is extremely limited.

35279 **APTIC NO. 58152**

Skorik, L. D. and L. M. Tsirul nikov

THE PART PLAYED BY ATOMIC AND MOLECULAR OXYGEN IN THE FORMATION OF SO3 WHEN BURNING NATURAL GAS OF HIGH SULPHUR CONTENT. *Thermal Eng. (English translation from Russian of: Teploenergetika), 20(3):115-117, 1973. 11 refs.*

To assess the role of atomic and molecular oxygen in the mechanism of sulfur trioxide formation, thermodynamic calculations were made of the equilibrium states of the combustion products of the high-sulfur natural gas-air system. The calculations were made for temperatures from 200 to 3000 K in the region of 0.6 less than or equal to alpha less than or equal to 1.5 at pressures in the combustion chamber of 1 kgf/sq cm for natural gas of the composition (% by volume): hydrogen sulfide, 2; carbon dioxide, 2.5; nitrogen, 4.5; methane, 83.95; ethane, 5; propane, 0.9; butane, 0.25; and pentane, 0.9. This fuel was chosen because, in contrast to solid and liquid fuels it has no mineral matter, and there is no appreciable quantity of soot particles in its combustion products which, like ash particles, can cause theoretical data to differ from experimental data. The calculations were made for a homogeneous gas system without allowing for the catalytic effect of the heating surface. The determining role in the mechanism of the formation of SO3 is played by molecular oxygen, oxidizing sulfur monoxide and sulfur dioxide to SO3. This is confirmed by tests on combustion of sulfur-containing fuels reported in the literature which show that with an increase in alpha there is an increase in the concentration of SO3 and of sulfuric acid corrosion.

35280 **APTIC NO. 58127**

Stauffer, D., V. A. Mohnen, and C. S. Kiang

HETEROMOLECULAR CONDENSATION THEORY APPLIED TO PARTICLE GROWTH. *J. Aerosol Sci., 4(6):461-471, Nov. 1973. 8 refs.*

The growth of aqueous sulfuric acid droplets originating from a heteromolecular nucleation process is calculated for particle sizes up to 1000 A. Two cases are discussed: there exists a given initial concentration of a condensable trace gas; and there exists a constant production rate of a condensable trace gas. The particle growth and the final particle size are calculated as functions of relative humidity from 10 to 99%. Previous studies on heteromolecular nucleation (Kiang et al, 1973) as applied to gas to particle conversion are extended to the particle growth process and found to agree roughly with experiments by Cox (1973).

35281 **APTIC NO. 57879**

Tsang, W.

THE COMBINATION OF HO WITH NO. *In: Chemical Kinetics Data Survey VI. Photochemical and Rate Data for Twelve Gas Phase Reactions of Interest for Atmospheric Chemistry. National Bureau of Standards, Washington, D. C., Institute for Materials Research, NBSIR 73-207, p. 15-20, Aug. 1973. 10 refs.*

The chemical kinetics on the combination of hydroxides with nitric oxide is presented. Experimental results are in satisfactory agreement that all the data can be fitted with a maximum deviation of + or 40%. The present fit is based on RRKM calculations (g,h) assuming a loose complex and with an overall rotations active.

35282 APTIC NO. 58170

Westenberg, A. A. and N. deHaas

RATE OF THE REACTION OH PLUS H2S YIELDS SH PLUS H2O OVER AN EXTENDED TEMPERATURE RANGE. *J Chem. Phys., 59(12):6685-6686, Dec. 15, 1973. 6 refs.*

Rates of reaction for the exothermic conversion of hydroxides plus hydrogen sulfide to the sulfhydryl radical plus water were studied for temperatures ranging from 298 K to 885 K. Very low hydrogen flows were dissociated in the discharge (about 0.02% of the helium flow) to assure operation in the first-order OH decay regime; and the H signal was titrated to extinction with nitrogen dioxide before H2S was turned on so that no H remained to react with H2S. The (H2S)/(OH) ratio was always at least 8-10 so that the pseudo-first order condition was reasonably well met. Logarithmic OH decay plots were of excellent linearity over factors of 3-10. Five to seven runs were carried out at each of four temperatures; and the averaged results for the rate constant (in cu cm/mole sec times 10 to the minus 12) were: 3.3 plus or minus 0.2 (298 K), 4.6 plus or minus 0.0 (386 K), 6.9 plus or minus 0.4 (591 K), and 8.8 plus or minue 0.3 (885 K).

35283 APTIC NO. 55829

Wojtczak, Jan and Marian Elbanowski

PHOTOCHEMICAL PROPERTIES OF THE SYSTEM: CARBON DISULPHIDE-SIMPLE UNSATURATED HYDROCARBONS. *(Fotochemiczne wlasnosci ukladu: dwusiarczek wegla-proste nienasycone weglowodory. Text in Polish. Poznan. Towarz. Przyjaciol Nauk Wydzial Mat. Przyrod. Prace Komisji Mat. Przyrod., 13(2):41-55, 1973. 32 refs.*

The photochemical properties of systems containing carbon disulfide and ethylene or propylene (in gaseous phase) and propylene or cyclopentene (in liquid phase) were investigated by ultraviolet irradiation with low (254 nm) and high (238-579 nm) pressure mercury lamps and subsequent elemental, spectrophotometric, and gas chromatographic analysis. Carbon disulfide exhibited absorption maxima at 210 and 320 nm, and the molar absorption coefficient at the latter wavelength was 64. Irradiation resulted in excitation of the CS2 molecules, and secondary reactions yielded a practically insoluble polymer containing the group (CS)x as well as other sulfides. Cyclopentene, ethylene, and propylene had absorption maxima beyond the applied range of radiation. Irradiation of the systems failed to reveal volatile photoproducts in detectable amounts. Formation of products with highest yield, especially as a result of irradiation of the CS2-cyclopentene system, indicated activity of the double bond in the unsaturated hydrocarbon. Spectroscopically, the photoproducts appeared polymeric in nature.

1972

35284 APTIC NO. 58300

Abidova, M. G. and Sh. A. Iskandarov

NICKEL CATALYSTS IN THE HYDROCRACKING PROCESS. *Int. Chem. Eng., 12(2):226-228, April 1972. 4 refs.*

Experiments were performed in a high-pressure apparatus of the continuous flow type with a working volume of 300 cu cm to investigate the possibility of using nickel catalysts in a single stage hydrocracking process for heavy petroleum products (heavy vacuum gas oil). Optimum hydrocracking conditions were: temperature 425 C, pressure 50 atm, and volumetric feed rate 1/hr. An increase in pressure lowered the cracking capacity of the catalyst, and hydrogenating activity fell sharply at temperatures above 425 C. An absence of heavy aromatic hydrocarbons in the catalyzate indicated that the catalyst had a high hydrogenation activity, and the predominance of paraffin hydrocarbons with iso-structures in gasolines obtained with the catalyst corresponded to the high isomerizing capacity of nickel catalysts. The nickel catalyst possessed a high capacity to crack and isomerize despite the high sulfur content of the feedstock, though subsequent hydropurification appeared necessary.

35285 APTIC NO. 57831

Barbe, C., D. Roger, and A. Grange

TWO-PHASE FLOW HEAT EXCHANGES AND PRESSURE LOSSES IN SPOOL-WOUND EXCHANGER SHELLS. *Pipeline Gas J., 199(11):82-83, 87, Sept. 1972. 11 refs.*

The importance of heat exchangers in a natural gas liquefaction plant has led to the development of a calculation method of heat transfer coefficients and pressure drops for the refrigerating fluid that vaporizes on the shell side, while the natural gas condenses countercurrently within the tubes. The calculation procedures which are applicable to two-phase flow in the spool-wound exchanger are based on a separated flow model. The correlations established for both upward and downward streams were tested with an air-water mixture as far as the pressure drop was concerned and with propane, propane-ethane, and propane- ethane-methane mixtures as far as pressure drop and heat transfer coefficient were concerned. A concordance of experimental results with the theoretical calculations for various fluids testified to the model s merits.

35286 APTIC NO. 58299

Kafarov, V. V., V. V. Shestopalov, and V. P. Bel kov

LONGITUDINAL MIXING OF LIQUID IN A PLATE COLUMN WITH SIEVE TRAYS FOR THE ABSORPTION OF NITRIC OXIDE. *Int. Chem. Eng., 12(2):257-259, April 1972. 3 refs.*

Studies were performed on the longitudinal mixing of liquid in a plate column with sieve trays for the absorption of nitric oxide, and an empirical relationship was obtained for the coefficient of longitudinal mixing as a function of the operating parameters. The change in the liquid concentration over the tray length was described by a diffusion model, and the coefficient of longitudinal mixing for normal sieve trays with coils fitted on them was about 25-35% lower over the range of liquid loadings 0.6-2.5 cu m/hr.

35287 APTIC NO. 58288

Kaplan, M. L. and P. G. Kelleher

POLYDIENE OXIDATIONS WITH SINGLET OXYGEN. *Rubber Chem. Technol., 45(2):423-436, April 15, 1972. 43 refs. (Presented at the American Chemical Society, Division of Rubber Chemistry Meeting, 100th, Cleveland, Ohio, Oct. 12-15, 1971.)*

The chemical preparation of excited molecular oxygen in its si glet detal (1 delta g) state in a homogeneous solution and in the gas phase by the electrodeless discharge of ground state oxygen is described. Both techniques have been used to perform oxidations of polydiene systems. Solutions of high cis, trans, and vinyl polybutadienes were treated with singlet O2 produced in situ. Only the high cis and high trans were oxidized, apparently by different mechanisms. Squalene, a model for polyisoprene, was oxidized in solution and the initially formed hydroperoxides reduced and analyzed and found identical to the product from a photosensitized oxidation. Cis-polybutadiene films were treated with gas-phase singlet oxygen and the extent of surface oxidation was monitored spectroscopically and chemically. (Author summary modified)

35288 **APTIC NO. 58293**

Lieberman, A., H. M. Ogle, and C. Falkner

INVESTIGATIONS OF A CONTINUOUS FLOW SINGLE PARTICLE CONDENSATION NUCLEI COUNTER. *Harvard Univ., Cambridge, Mass., Harvard Air Cleaning Lab., Atomic Energy Commission, Washington, D. C., Div. of Occupational Safety and Div. of Waste Management and Transportation, and Oak Ridge, National Lab., Tenn., Atomic Energy Commission Air Cleaning Conf., 12th, Oak Ridge, Tenn., 1972, p. 281-290. 6 refs. (Aug. 28-31.)*

NTIS: CONF - 720823

A combination of an optical single particle counter with a continuous flow cloud chamber was investigated as a sub-micron particle analyzer. The flow, temperature, and pressure characteristics necessary to maintain nuclei activation and particle growth were explored as well as the conditions necessary to grow and detect individual particles in the 0.01 micron size range. The experiments reported were conducted with water vapor; and, for the most part, data were obtained in terms of total number of droplets larger than 0.5 micron observed. Examination of the effect of change in the power input to the nichrome wire under constant conditions of temperature and flow showed that the logarithm of the nuclei concentration was a direct function of the power input to the nuclei source. Droplet concentration increased to an asymptotic value for any single supersaturation as the time increased, indicating that all of the available nuclei had grown to optically countable size. More nuclei were found activated as the available moisture increased.

35289 **APTIC NO. 55940**

Nicolet, Marcel

THE BIOSPHERE IN THE SERVICE OF THE ATMOSPHERE. *(La Biosphere au service de l Atmosphere). Text in French. Bull. Cl. Sci. Acad. Roy. Belg., 58(5):1431-1437, 1972.*

Interactions occurring between natural and anthropogenic emissions from the biosphere and atmospheric gas consttuents are described. Ultraviolet radiation at wavelengths below 3200 A produces excited oxygen atoms, a small fraction of which react with water vapor, methane, and hydrogen, yielding free hydroxyl groups which again react with methane and hydrogen. The destruction of CH4 leads to the formation of carbon monoxide which, reacting again with hydroxyl groups, yields carbon dioxide. Nitrous oxide emitted by soil bacteria reacts with excited oxygen atoms in the atmosphere to yield nitric oxide. Photochemical equilibrium between atmospheric NO and nitrogen dioxide was evidenced. The OH radical resulting from the decomposition of water vapor reacts with NO2 to yield nitric acid which is then washed out by precipitation.

35290 **APTIC NO. 58282**

Reddy, Y. B.

FLOW OF A DUSTY VISCOUS LIQUID THROUGH RECTANGULAR CHANNEL. *Defence Sci. J. (New Delhi), 22(3):149-152, July 1972. 6 refs.*

The laminar flow of an unsteady liquid with uniform distribution of dust particles through a rectangular channel under the influence of an exponential pressure gradient with respect to time has been investigated. The influence of the presence of the dust particles on fluid particles is discussed and graphs of velocity profile are drawn. Both the fluid and dust particles which are nearer to the axis of cylinder move with greater velocity. When the dust is very fine, the relaxation time of the dust particles decreases. As the mass of the dust approaches zero, the velocity of dust and fluid particles will be the same. If the masses of the dust particles are small, their influence on the fluid flow is reduced, and in the limit as mass approaches zero the fluid 0becomes ordinary viscous. The solution that was derived for the fluid with dust flow thus yields, in this limit, the solution of the laminar flow of a viscous liquid through a rectangular channel under the influence of an exponential pressure gradient with respect to time.

35291 **APTIC NO. 58279**

Rosen, J. D.

CONVERSION OF PESTICIDES UNDER ENVIRONMENTAL CONDITIONS. *In: Environmental Quality and Safety: Chemistry, Toxicology and Technology. Frederick Coulston and Friedhelm Korte (eds.), Vol. 1, New York, Academic Press, Inc., 1972, p. 85-96. 54 refs.*

There are only few known nonphotochemical reactions of pesticides in the inanimate environment and these are mainly hydrolyses. Photochemical reactions on ultraviolet irradiation, in sunlight and under field conditions (if known) are reviewed for chlorinated cyclodienes, carbamates, diphenylates, thiophosphates, and herbicides (with aromatic halogen, phenoxy acids, chlorinated phenols, phenylureas, anilides, and bipyridylium salts). Only few data are available on the persistence, toxicology, and ecological implications of the photoconversion products, and also on the rates at which these reactions occur. The effects of naturally occurring and synthetic photosensitizers are not sufficiently known. (Author summary)

35292 **APTIC NO. 58069**

Vakhrushev, I. A. and V. A. Basov

THE FORMATION OF PRIMARY BUBBLES IN A FLUIDIZED BED. *Int. Chem. Eng., 12(2):319-324, April 1972. 5 refs. (Also: Khim. Prom., no. 6:467-471, 1971.)*

An equation is derived for the apparent viscosity of a fluidized bed during the passage of permeable bubbles. Results of calculations for large bubbles, neglecting the leakage of gas, are in good agreement with the experimental and theoretical data given in the literature as are those for small bubbles, neglecting gas leakage through the bubble cap. Thus the validity of the equation for the apparent viscosity of a fluidized bed during the passage of permeable bubbles through it is confirmed.

35293 **APTIC NO. 57914**

Westley, Francis

CHEMICAL KINETICS IN THE C-O-S AND H-N-O-S SYSTEMS: A BIBLIOGRAPHY-1899 THROUGH JUNE 1971. *National Bureau of Standards, Washington, D. C., Chemical Kinetics Information Center, NBS Special Publication 362, 72p., April 1972. 342 refs.*

GPO

A bibliography of papers and reports on the gas phase reaction kinetics in the carbon-oxygen-sulfur, C-S, and hydrogen-nitrogen- O2-S systems is presented. Rate data are included for reactions of COS, COS2, CS, carbon disulfide, CS3, D2S, hydrogen sulfide, H2S2, HSO2, S, SH, sulfur oxide, sulfur dioxide, sulfur trioxide, sulfate, S2, S2O2, S4, S6, and S8 with each other and with carbon monoxide, carbon dioxide, deuterium, D2, H, H2, water, N, N2, nitrous oxide, nitric anhydride, nitric oxide, nitrogen dioxide, nitrogen trioxide, NOS, O, hydroxide, O2, ozone, R, and RH. Three lists of critical reviews dealing with the above reactions are included. There are 317 papers covering 240 reactions. The period covered extends from 1899 through June 1971. (Author abstract modified)

1971

35294 **APTIC NO. 58073**

Cardinale, A., V. Gervasio, A. Marzocchi, and E. Nardelli

A PROPOSED APPROACH ON MODELING TECHNIQUES FOR ECOLOGICAL PURPOSES USING DYNAMIC CRITERIA. *North Atlantic Treaty Organization, Committee on the Challenges of Modern Society,* *Proc. Expert Panel Air Pollut. Modeling, 2nd Meet., Paris, France, 1971, p. II-1-II- 20. 7 refs.*

A dynamic approach to modeling techniques for ecological purposes is presented which consists of reducing any problem to a block diagram and considering correlations among various compartments in mathematical terms. The concept of key-substance is introduced and defined as a reference substance existing in all compartments and constituting the exchange vehicle among them. A living community may then be described in terms of one or more of these key substances such as nitrogen for example, and an ecosystem may be considered as the whole of compartments affected by a key substance interchange. The proposed mathematical model allows for plotting pollutant concentration versus time in any compartment when a foreign element, such as a pollutant, is introduced by any pathway in the ecosystem and such pollutant takes part in exchange mechanisms among the various compartments. An application is presented dealing with the effect of iodine-131 on the ecological chain. (Author summary modified)

35295 APTIC NO. 58277

Finnegan, W. G., L. A. Burkardt, and P. St.-Amand

GENERATION OF ATMOSPHERIC TRACER MATERIALS. *Australian Academy of Science and American Meteorological Society, Boston, Mass., Int. Conf. Weather Modification Proc., Canberra, Australia, 1971, p. 355. 4 refs. (Sept. 6-11.)*

The feasibility of using conventional airborne silver iodide-acetone burning generators for atmospheric tracer generation was investigated. Indium oxide and lithium chloride were selected for initial study. Lithium perchlorate trihydrate is quite soluble in acetone; solutions containing 18.9% lithium perchlorate trihydrate are readily prepared, and can be burned without hazard. This solution, when burned in a ground generator, yielded LiCl having a particle size distribution ranging from 0.27 micron to 0.63 micron with a mean of 0.45 micron. Indium nitrate is soluble in acetone-water solutions. A 10% indium nitrate, 12.5% water, 77.5% acetone solution, burned in the ground generator, yielded pure In2O3 having a 0.05 micron to 0.35 micron size distribution. A literature survey of potential tracer materials and their solubilities suggests that compounds of other metals are possible of generation.

35296 APTIC NO. 58248

Foote, Christopher S.

MECHANISM OF ADDITION OF SINGLET OXYGEN TO OLEFINS AND OTHER SUBSTRATES. *Pure Appl. Chem., vol. 27:635-645, 1971. 31 refs.*

Mechanisms of addition of singlet oxygen to various classes of substrates have been surveyed. The experimental data for the allylic hydroperoxidation are best fit by a concerted ene-type mechanism, while the addition of dienes is probably a Diels-Alder reaction. Addition of 1,2-Cycloadditions to electron-rich olefins may proceed by a 1,4-dipolar mechanism, although there is as yet little evidence. Addition to sulfides may go by a very similar nucleophilic addition to oxygen. (Author abstract)

35297 APTIC NO. 58109

Lebowitz, Michael D.

A STIMULUS RESPONSE METHOD FOR THE ANALYSIS OF ENVIRONMENTAL AND HEALTH EVENTS RELATED IN TIME. *Environ. Letters, 2(1):23-34, 1971. 7 refs.*

A new stimulus response method for the analysis of the relationship of two or more complex series of events over time, viz., daily mortality and air pollution conditions, has been developed. The model is a good example of the concept of multiplex variables. The stimuli are meant to represent the complex, multivariate, interacting environmental variables of the air pollution-weather environment, whose components could not possibly explain the relationship between stimuli and responses. The response variable is also multiplex in that it contains the set of conditions, mortality in the 65 year plus age group, which intend and represent a complex state of events. The model has been tested by studying the relationship between mortality and antecedent air pollution and weather occurring daily in New York, Philadelphia, and Los Angeles, and has yielded statistically positive results.

1970

35298 APTIC NO. 579[illegible]4

Hanson, R. K., W. L. Flower, and C. H. Kruger

DETERMINATION OF THE RATE CONSTANT FOR THE REACTION O + NO YIELDS N + O2. *Preprint, Stanford Univ., Stanford, Calif., Dept. of Mechanical Engineering, 27p., 1970 (?). 14 refs.*

The rate constant for the reaction oxygen (O) + nitric oxide yields nitrogen (N) + oxygen (O2) was determined in the temperature range 2500-4100 K using a shock-tube technique. Mixtures of nitric oxide and nitrous oxide diluted in argon or krypton were heated by incident shock waves, and the infrared emission from the fundamental vibration-rotation band on NO at 5.3 micron was used to monitor the time-varying NO concentration. The N2O served as a quick source of oxygen atoms so that the effects of other reactions in relating the reaction constant to the measured rate of NO removal were minimal. The data are fit closely by the expression reaction constant equals 2.36 times 10 to the 9th power T (temperature) exp(-38,640/RT) cu cm/mole-sec, which also provides a good fit to previous data at higher and lower temperatures. (Author abstract)

1969

35299 APTIC NO. 58297

Benson, S. W., F. R. Cruickshank, D. M. Golden, G. R. Haugen, H. E. O Neal, A. S. Rodgers, R. Shaw, and R. Walsh

ADDITIVITY RULES FOR THE ESTIMATION OF THERMOCHEMICAL PROPERTIES. *Chem. Rev., vol. 69:279-324, 1969. 307 refs.*

Additivity rules for the estimation of thermochemical properties are reviewed. The types of compounds included are alkanes, alkenes, alkynes, aromatic hydrocarbons, polyaromatic hydrocarbons, cyclin alkanes and alkenes, oxygen-containing compounds, amines, imines, cyanides, nitro compounds, nitrites, nitrates, hydrazines, azo compounds, tetrazines, amides, imides, nitrogen containing ring compounds, miscellaneous and unique group nitrogen containing compounds, halogen containing compounds, organosulfur compounds, organophosphorus compounds, organoboron compounds, organometallic compounds, and miscellaneous sulfur, boron, phosphorus, and organometallic compounds. The contributions were tabulated as a function of temperature and all values predicted from the group tables refer to the gas phase.

35300 APTIC NO. 57877

Cruickshank, F. R. and S. W. Benson

THE CARBON-HYDROGEN BOND DISSOCIATION ENERGY IN METHANOL. *J. Phys. Chem., 73(3):733-737, March 1969. 14 refs.*

The carbon-hydrogen bond dissociation energy in methanol was determined at a lower limit. This yields a relatively accurate value to calculate the pi bond strength of formaldehyde, D pi O. Methanol was expanded into the reactor containing the desired pressure of iodine and the optical density monitored as a function of time at 445 micron. The optical density was monitored sequentially at 445, 280, and 260 micron. A sample of the condensed gas was analyzed for methane and carbon monoxide. The results are tabulated. Methyl iodide was also detected and spot analyses were performed on the spectrophotometer. Runs in which CH4 is produced have rate constants equal, within experimental error, to those calcualted for runs in which no CH4 was produced. The value of El leads to a C-H strength of 95.5 + or 2 kcal/mol for MeOH which is greater than the limits set by the study of the photobromination of MeOH.

35301 **APTIC NO. 58287**

Setser, D. W. and W. C. Richardson

CALCULATED R.R.K.M. UNIMOLECULAR DISSOCIATION RATE CONSTANTS FOR HYDRAZINE. *Can. J. Chem., 47(14):2593-2599, 1969. 21 refs.*

Unimolecular rate constants for hydrazine dissociation by thermal and chemical activation were calculated according to the Rice Ramsperger Kassel Marcus (R.R.K.M.) theory. The two activated complex models used in the calculations represent plausible upper and lower bounds to the rate constants. The calculations were mainly directed toward establishing expected decomposition to stabilization ratios of N2H4 produced by combination of NH2 radicals. However, a general comparison to available experimental data for hydrazine dissociation is made. (Author abstract modified)

35302 **APTIC NO. 57979**

Subramanyam, M. V. and N. R. Kuloor

DUST DEPOSITION ON SINGLE CYLINDERS. *Ann. Occupational Hyg., 12(1):9-25, Jan. 1969. 19 refs.*

The inertial impaction of Lycopodium spores on single wires lying transverse to the direction of flow was studied. The equations of particle motion in a potential flow field were modified for the case when Stokes law is inapplicable. Solutions to this equation were obtained by digital computation. The Reynolds number, Re(c), based on cylinder diameter varied from four to 240; particle trajectories in a flow field at Re(c) equals 10 were determined for inertial parameter K equals 1, 2, 4, 6, and 10. Ten trajectories were developed for the above cases by the numerical stepwise method. Experiments were performed by depositing Lycopodium spores on adhesive-coated wires of various diameters and at different velocities. The weight of dust deposited was determined with a microbalance. The effect of particle size on collection efficiency was also estimated. (Author abstract modified)

35303 **APTIC NO. 58094**

Wayne, R. P. and J. N. Pitts, Jr.

RATE CONSTANT FOR THE REACTION O2(1-DELTA-g) + O3 YIELDS 2O2 + O. *J. Chem. Phys., 50(8):3644-3645, April 1969.*

The determination of the rate constant for the reaction from intensity measurements at 1.27 micron using a conventional discharge-flow system is described. Flow velocities were approximately 0.3 to 1.0 m/sec, and total concentrations of oxygen (1-delta-g) and ozone ranged between 0.0009 and 0.0006 mol/L. Good first O3 decay plots were obtained, with the first order rate constants obtained as a function of ozone concentration. No significant change in decay rate was obtained when 02(1-delta-g) concentration was varied by a factor of two. Results of the determinations showed the rate constant were 1,700,000 + or 500,000 L/mole/sec at 25 C, which was in good agreement with the results obtained by the photoionization technique.

1968

35304 **APTIC NO. 58290**

Chakraborty, B. B. and R. Long

THE FORMATION OF SOOT AND POLYCYCLIC AROMATIC HYDROCARBONS IN ETHYLENE DIFFUSION FLAMES WITH METHANOL AS AN ADDITIVE. *Combustion Flame, 12(2):168-169, April 1968. 5 refs.*

The influence of methanol on the formation of soot and polycyclic aromatic hydrocarbons (p.c.a.h.) when mixed with the ethylene fuel of a diffusion flame was investigated. Various amounts of methanol were introduced into the ethylene supply by saturating it at different temperatures. The amounts of dry soot, carbonaceous residue, chloroform-soluble material, and p.c.a.h. decrease with an increase in methanol concentration.

35305 **APTIC NO. 58970**

Cutlip, M. B. and M. S. Peters

HETEROGENEOUS CATALYSIS OVER AN ORGANIC SEMICONDUCTING POLYMER MADE FROM POLYACRYLONITRILE. *Chem. Eng. Progr. Symp. Ser., 64(89):1-11, 1968. 20 refs.*

An organic semiconductor, pyrolyzed polyacrylonitrile, has been shown to be a heat-stable catalyst which can be used in a manner similar to inorganic oxide catalysts for the dehydration of tertiary butyl alcohol. Adsorption of the products from this reaction significantly affected the reaction rate and should hence be considered in any mechanism. A possible mechanism in which the catalytic activity of the polymer is attributed to Bronsted acid sites was used to derive Hougen and Watson types of rate expressions. Mathematical modeling, using nonlinear regression on various rate equations with Arrhenius temperature relationships, did not give a single best model. Instead, both the single and dual site reaction controlling models with adsorption terms for all of the reaction components satisfactorily correlated the experimental results. The use of an empirical power law rate expression gave a statistically less desirable fit than the final Hougen and Watson rate equations. (Author conclusions modified)

35306 **APTIC NO. 57833**

Dave, J. V.

SUBROUTINES FOR COMPUTING THE PARAMETERS OF THE ELECTROMAGNETIC RADIATION SCATTERED BY A SPHERE. *International Business Machine Corp., Palo Alto, Calif., Data Processing Div., Rept. No. 320-3237, 67p., May 1968. 28 refs.*

Two experimental FORTRAN subroutines with which one can compute the so-called Efficiency Factors and the Stokes parameters of the electromagnetic radiation scattered by a sphere (Mie scattering) are presented in great detail. One of the subroutines, called DBMIE, is expected to give reliable results under all foreseeable conditions; while the other which is known as DAMIE is expected to produce reliable results only when the moderate and large spheres are made of non-absorbing material. The subroutines are fairly efficient in terms of storage requirements and timing considerations; however, since they are basically general purpose subroutines, more efficient versions can be obtained after appropriate changes.

1967

35307 **APTIC NO. 58289**

Degraff, B. A. and G. B. Kistiakowsky

THE PHOTOLYSIS OF KETENE IN THE PRESENCE OF CARBON MONOXIDE. *J. Phys. Chem., vol. 71:1553, 1967. 9 refs.*

The photolysis of ketene in the presence of carbon monoxide was investigated. The quantum yields of ethane, ethylene, and acetylene from the photolysis of ketene in the presence of CO, nitrogen, oxygen, and heat were measured at four wavelengths and different pressures. The rates of reaction of the two species of methylene with CO were quite different. The triplet species reacts more readily with CO than does singlet methylene. The probable products of triplet reactions (ethane and acetylene) are removed and O2 has no effect on the ethylene quantum yield at sufficiently high concentrations of CO. The relative amount of singlet methylene increases with increasing photon energy.

35308 **APTIC NO. 57837**

Markvart, M. and V. Pour

THE INFLUENCE OF OXYGEN ON THE CATALYSTIC REDUCTION OF NITRIC OXIDE BY AMMONIA. *J. Catalysis, 7(3):279-281, 1967. 7 refs.*

The influence of oxygen on the catalytic reduction of nitric oxide by means of ammonia was examined. Reactions were performed on a PtAl2O3 catalyst in an integral flow reactor at atmospheric pressure. The composition of the gas mixture entering the reactor was 0.4% NO and 0.4% NH3 or 0.4% NO, 0.4% NH3, and 3% O2, with the remaining always nitrogen. The output was 301 (STP) of the mixture per gram of the catalyst per hour. Determination of the total amount of nitrogen oxides in the gas outflow was made after the removal of unconsumed ammonia. The nitric oxide conversion was temperature-dependent. In the presence of oxygen the same conversion values were attained at appreciably lower temperatures than in its absence; thus, oxygen enhances the reaction rate. A possible reaction mechanism is discussed.

35309 **APTIC NO. 58001**

Murray, R. W., R. D. Youssefyeh, and Paul R. Story

OZONOLYSIS. STERIC AND STEREOCHEMICAL EFFECTS IN THE OLEFIN. *J. Am. Chem. Soc., 89(10):2429-2434, May 10, 1967. 18 refs.*

Ozonolysis of a series of cis and trans olefins indicates that the ozonide cis:trans ratio produced in both normal ozonides and cross-ozonides is a function of both olefin stereochemistry and steric effects in the olefin. Isolation of an epoxide in which the olefin stereochemistry has been preserved has been observed in the case of one trans olefin. The mechanistic consequences of these results are discussed. (Author abstract)

1966

35310 **APTIC NO. 58032**

Wecker, M. and T. Baurer

COMMENT ON THE FOUR-CENTER AIR REACTION. *Pyrodynamics, 4(1):57-58, Jan. 1966. 7 refs.*

The discrepancy between the rate constant for the reaction nitrogen plus oxygen yields 2 nitric oxide and its reverse and another widely used constant of half the value is discussed. The discrepancy is attributed to the manner in which the authors presented their experimental results.

1964

35311 **APTIC NO. 57823**

Barrier, R. M. and A. F. Denny

WATER IN HYDRATES. II. LIGHT AND HEAVY WATER AND SULPHUR DIOXIDE IN SYNTHETIC ZEOLITES. *J. Chem. Soc., 1964:4684-4692, Dec. 1964. 27 refs.*

Sorption of light (H2O) and heavy water (D2O) and of sulfur dioxide by a number of synthetic zeolites was studied. Sorption of water was reversible in zeolites Na-X and Na-A; it was irreversible in Na-A, Ca-A, Na-Y and basic sodalite, revealing hysteresis effects of considerable complexity. Sorption of sulfur dioxide was reversible on the X, Y, and A zeolites, but on basic sodalite sorption was very slow and a side reaction yielded some sulfur on outgassing. When reversible sorption of water occurred, the differences in sorption of liquid D2O and H2O in Na-X and Na-A were negligible but small differences existed for uptake of the vapors. This agrees with results previously observed for chabazite, gmelinite, and heulandite. (Author abstract modified)

1963

35312 **APTIC NO. 58004**

Nakashio, Fumiyuki

COMBUSTION RATE OF LOW GRADE COAL WITH AIR IN THE FLUIDIZED BED REACTOR. *(Ryuhdorsoh niyoru teihin itan no nenshohsokudo nitsuite). Text in Japanese. Kagaku Kogaku (Chem. Eng.), 27(1):957-962, Jan. 1963. 4 refs.*

To clarify the rate of combustion of low-grade coal in a heterogeneous exothermic reaction, an Arrhenius equation was proposed for the specific rate of heat generation, in terms of the reaction temperature change in a fluidized bed reactor. The validity of the theory, where the composition of the basic material and reaction products is not sufficiently known and the composition of each solid particle is not uniform, was proved by an experiment. The apparent activation energy was calculated to be about 17 kcal/ mole in the temperature range of 600-900 K. Decreasing the rate of air supply increased the temperature change, while decreasing the amount of coal decreased the temperature change. Study of the effect of inlet air temperature on the temperature change revealed the existence of a critical point at about 370 C, where a drastic change in characteristics was observed. The smaller the particle size, the less the temperature change. The increase in the heating rate of the fluidized bed through the reactor wall increased the temperature change. Those temperature-change characteristics were used to calculate the combustion rate. Agreement and some disagreement of the results with those of other authors are discussed.

35313 **APTIC NO. 58002**

Sartori, Guido and Claudio Ercolani

THE ABSORPTION OF NO ON SOLID FE(II)-PHTHALOCYANINE. *(Assorbimento di NO su Fe-(oso)-ftalocianina allo stato solido). Text in Italian. Ric. Sci. Rend. A, 3(3):323-327, 1963. 9 refs.*

The absorption of nitric oxide on solid iron(II)-phthalocyanine was considered and studied from a quantitative view point. The research was completed with measurements of magnetic susceptibility and with infrared spectra in the 700-5000/cm region. The Fe(II)-phthalocyanine absorbs NO in the molecular ratio 1:1. This absorption also causes the disappearance of all infrared spectrum maxima characteristics of Fe-beta-phthalocyanine.

1962

35314 **APTIC NO. 57867**

Erdos, E.

EQUILIBRIA IN THE SYSTEMS SO2-CO2-M(M)O. *Collection Czech. Chem. Commun. (Prague), vol. 27:2152-2167, 1962. 2 refs.*

A general analysis of the properties of systems consisting of gaseous sulfur dioxide, carbon dioxide and solid metal oxide was carried out with respect to the equilibrium pressures of SO2. On the basis of these and previous results, the equilibrium pressures of SO2 were calculated for 24 systems of this type. The results showed that, within the range considered, the presence of CO2 had a significant effect on the equilibrium pressures of SO2. The presence of CO2 at a partial pressure of 0.15 atm and 150 C in the SO2-CO2-MgO system increased the equilibrium pressure of the SO2 by a factor of four. All the oxides or carbonates of alkali metals, alkaline earth metals (except magnesium), and some heavy metals (lead and silver) appear promising from a thermodynamic point of view for use in separating SO2 from flue gases.

1958

35315 APTIC NO. 57865

Diyev, N. P., V. V. Paduchev, and V. V. Toporova

REACTION OF IRON SULFIDES WITH SULFUR DIOXIDE. *(Vzaimodeystviye sul fidov zheleza s sernistym angidridom). Text in Russian. Tr. Inst. Met. Akad. Nauk SSSR, Ural. Filial, no. 2:95-105, 1958. 21 refs.*

The reaction of solid iron sulfides with sulfur dioxide and the reverse reaction of solid magnetite with sulfur at 700-1180 deg were studied; it was established that reaction equilibrium depends on the quantity of troilite present in the system. Troilite content in reaction products was close to Fe9S8 for temperatures up to 900 deg, and close to Fe11S12 at higher temperatures. The true chemical equilibrium system, Fe11S12 (Fe7S8), Fe3O4, SO2, S2, was determined using S (35) isotope. The logarithm of the equilibrium constant for this system was determined.

1955

35316 APTIC NO. 57986

Bretsznajder, S.

ABSORPTION OF SULFUR DIOXIDE IN SOLUTIONS OF BASIC ALUMINUM SULFATE. V. DETERMINATION OF THE EXTENT OF THE OXIDATION OF THE ABSORBED SULFUR DIOXIDE BY OXYGEN. *(Absorpcja dwutlenku siarki w roztworach zasadowego siarczanu glinowego V Okreslenie obszaru reakcji utileniania zaabsorbowanego dwutlenku siarki tlenem). Text in Polish. Przemysl Chem., vol. 11:115-117, 1955. 8 refs.*

In an earlier study it was found that the rate of oxidation of sulfur dioxide which has been absorbed in a basic solution of aluminum sufate was independent of the extent of the reaction, of the partial pressure of the oxygen in the gaseous phase, of the concentration of the sulfur dioxide or basic aluminum sulfate, of the alkalinity of the solution, of temperature, of presence or absence of catalysts, or of light. This zero order reaction may be explainable if it is assumed that under the given condition the partial pressure of the oxygen above the solution remains constant over wide ranges of completion of the reaction. Tests conducted showed that at 20 C, the amount of oxygen diffused in these experiments is twice as great as the amount which reacts with the sulfur dioxide. In the 20-60 C range, or when a highly concentrated solution of aluminum salts is employed, the reaction occurs in the form of a typical chemical reaction. When the temperature rises above 70 C, or when the solution is dilute, reaction occurs in the diffusion range.

35317 APTIC NO. 58096

Kaufman, Frederick and John R. Kelso

THERMAL DECOMPOSITION OF NITRIC OXIDE. *J. Chem. Phys., 23(9): 1702-1707, Sept. 1955. 12 refs.*

The decomposition of pure nitric oxide and of mixtures of nitric oxide with helium or nitrogen were studied in spherical quartz vessels over a temperature range of 1170 to 1530 K. The extent of decomposition was determined spectrophotometrically. At temperatures above 1400 K, the reaction was homogeneous, and second-order rate constants represented the data throughout the course of decomposition. The activation energy was constant at 63.8 + or 0.06 kcal at temperatures above 1400 K. At lower temperatures, the rate constant depended slightly on the extent of decomposition due to the known heterogeneous nature of the reaction. There was a decreasing variation of the rate constant with percent decomposition as the temperature increased. In experiments in small and large quartz flasks at temperatures above 1400 K, the rate constant was independent of the surface to volume ratio, a strong indication of homogeneous decomposition in this temperature range. The addition of a fourfold excess of nitrogen or helium showed no significant effect on the rate of decomposition. The effect of the addition of excess oxygen was also investigated, and a mechanism which reconciles previously reported data was established.

1951

35318 APTIC NO. 58080

Baker, R. W., H. N. Wong, and O. A. Hougen

CATALYTIC OXIDATION OF NITRIC OXIDE ON SILICA GEL. *Ultrasonics, 47(1):103-109, 1951.*

A rate equation was developed for the catalytic oxidation of nitric oxide on silica gel. A flow sheet displays the experimental procedure used. The rate is a function of the surface reaction between oxygen in the gas phase and the nitric oxide complex (NO)2 adsorbed on the gel. Rate equations are established based upon unit mass of catalyst over the range of commercial interest.

1949

35319 APTIC NO. 57855

Johnston, Harold S. and Don M. Yost

THE KINETICS OF THE RAPID GAS REACTION BETWEEN OZONE AND NITROGEN DIOXIDE. *J. Chem. Phys., 17(4):386-392, April 1949. 11 refs.*

The kinetics of the rapid reaction between ozone and nitrogen dioxide were studied. This reaction may occur in the atmosphere immediately following a thunder clap. Three oxygen streams of known flow rates were used to pick up NO2 from a saturator containing cold liquid dinitrogen tetraoxide, to dilute the NO2 stream, and to produce ozone by passage through a silent electrical discharge tube. In a specially designed apparatus, the two resulting streams were mixed, then isolated in a reaction cell; the course of the reaction was followed photoelectrically in 0.1 sec or less by means of light absorption. The output of the photoelectric tube was recorded by a time exposure photograph of an oscilloscope screen. The kinetics of the fast gas reaction were studied over a tenfold range of concentrations of each reactant. The rate law was represented over the entire course of the reaction by the equation -d(O3)/dt equals k(NO2)(O3). From the temperature coefficient of the rate of action, the value for the energy of activation was 7.0 + or 0.6 kal/mole. A reaction mechanism is proposed and discussed. The reaction is related to and has interconnections with other kinetic systems involving higher oxides of nitrogen.

1935

35320 APTIC NO. 58036

Olin, H. L., J. D. Lykins, and W. P. Munro

ELECTRICAL CHARGES OF ACTIVATED CARBONS. *Ind. Eng. Chem., 27(6):690-693, June 1935.*

The adsorption of activated carbon was studied experimentally and cataphoresis (electrophoresis) was measured. A definite relationship existed between the intrinsic adsorptive capacity of a carbon as determined by the conventional gas adsorption method and its speed of migration in the cataphoresis cell while suspended in an aqueous medium of high pH value (11.5). The proof is the striking similarity between the curves obtained in plotting temperatures of activation against volumes of gas adsorbed and migration velocities, respectively. Results of studies on the cataphoretic behavior of carbons suspended in liquids of varying pH are shown graphically. In general, with shifting of the pH, the flow changes in velocity and direction, so that roughly within the limits of pH 1-5, two isoelectric points are located. (Author abstract modified)

1932

35321 APTIC NO. 58067

Allmand, A. J., L. J. Burrage, and R. Chaplain

DISCONTINUITIES IN ADSORPTION PROCESS. *Trans. Faraday Soc., vol. 28:218-222, 1932. 15 refs.*

The theory that the adsorption of vapors on charcoal is discontinuous has been supported. Experiments at low and moderate vapor pressures in the presence and absence air, using charcoal and silica gel adsorbents with carbon tetrachloride, carbon disulfide, benzene, water, and carbon dioxide as sorbates resulted in isotherms, all of which exhibited breaks. With an improved retentivity technique for both adsorbents, the isotherms above 0.1 mm consisted of sharply defined rectangular steps. Graphical presentation of these results are given.

1930

35322 APTIC NO. 57820

Zawadzki, J. and Z. Syryczynski

THE REVERSIBILITY OF REACTIONS BETWEEN SO2 + CAO AND CAS + CASO4. *(O odwracalnosci reakcyj pomiedzy SO2 i CaO oraz pomiedzy CaS i CaSO4). Text in Polish. Roczniki Chem., vol. 10:715-728, 1930. 4 refs.*

The conditions governing the equilibrium of the reaction: calcium sulfide + 3 calcium sulfate yields 4 calcium oxide + 4 sulfur dioxide or + 238.6 cal were studied. The reversibility of this reaction was demonstrated. The SO2 was also reacted with CaO and with the products of the decomposition of a mixture of CaS + 3 CaSO4. The equilibrium pressure of the SO2 were identical in all cases, despite the fact that the secondary reaction, CaS + 2 SO2 yields CaSO4 + sulfur + or 57.9 cal, changes the composition of the solid phase of the first system. The SO2 pressures when in contact with CaO at the start of flow saturation (passing the gas across a solid layer) were somewhat lower than the equilibrium value, but higher at the start of the decomposition of CaS + 3 CaSO4. It does not appear possible to explain these anomalies on an assumption of formation of solid solutions and intermediate compounds. The partial pressures of SO2 and S2 in a state of equilibrium were obtained by combining the results of the static and flow methods. Calculations with the aid of simplified Nernst equations gave the following average values for the thermal effects: 234.1 cal for the first equation; and 58.9 cal for the second equation.

1926

35323 APTIC NO. 57897

Stiles, Angie G. and W. A. Felsing

THE HEAT OF SOLUTION OF SULFUR DIOXIDE. *J. Am. Chem. Soc., 48(6):1543-1547, June 1926.*

The heat of solution of sulfur dioxide was measured directly by passing the gas into distilled water, measuring the temperature increase, and determining the concentration of the sulfurous acid produced. Six determinations averaged 38.66 cal. A regular determination was then carried out by passing sulfur dioxide through phosphorus pentoxide into a calorimeter. After the temperature rise was carefully noted, the solution was transferred to a buret and analyzed for sulfurous acid content by iodine titration. An equation was developed for the relation between cal/mole SO2 and moles H2O/mole SO2 which reproduced the experimental data to within 0.2%.

1925

35324 APTIC NO. 58193

Bangham, D. H. and F. P. Burt

SORPTION OF NITROUS OXIDE AND SULPHUR DIOXIDE BY GLASS. *J. Phys. Chem., vol. 29:540-550, 1925. 11 refs.*

Studies on the sorption of nitrous oxide and sulfur dioxide by a glass surface at 0 C are described, and the time and pressure relationships are discussed. The pressure-sorption relations for both gases are presented graphically.

1924

35325 APTIC NO. 57868

Bangham, D. H. and F. P. Burt

THE BEHAVIOR OF GASES IN CONTACT WITH GLASS SURFACES. *Proc. Royal Soc. (London) Ser. A., vol. 105:481-488, June 1924.*

The property possessed by glass surfaces of taking up small quantities of gases was explored in connection with the wetness and dryness of glass. A large surface area for experimentation was obtained by packing fine glass wool into a glass tube. The apparatus is diagramatically presented. Experiments were performed with carbon dioxide at pressures ranging from 6 to 657 mm. It was noted that the proportional fall of pressure with time was serious only when the initial pressure was very low. The results were tabulated, and the logarithms of the variables, sorption and time, were plotted. Linear graphs were obtained. Similar experiments were performed with nitrous oxide, sulfur dioxide, acetylene, and ammonia, whose sorption values were much greater than those of any of the other gases. There appeared to be a rough parallel between the activity of the different gases and their solubility in water.

1922

35326 APTIC NO. 57896

Smith, William Thompson and Reginald B. Parkhurst

THE SOLUBILITY OF SULFUR DIOXIDE IN SUSPENSIONS OF CALCIUM AND MAGNESIUM HYDROXIDES. *J. Am. Chem. Soc., vol. 44:1918-1927, July-Dec. 1922. 7 refs.*

This article reports an investigation of the solubility of sulfur dioxide in water, milk of lime (calcium hydroxide), and milk of magnesia (magnesium hydroxide) and includes a description of the apparatus used. Partial pressures of sulfur dioxide up to 760 mm, temperatures from 5 to 60 deg, all proportions of calcium and magnesium, and suspensions of total alkalinity up to one equivalent per liter were used in the experimental work. The concentration of sulfur dioxide as sulfurous acid was proportional to its partial pressure. With solutions of the same alkali concentration, the percentage salting-out effect increased with, but more than in proportion to, the temperature. With solutions of constant temperature, the percentage salting-out effect increased with, but less than in proportion to, the alkali concentration.

1918

35327 APTIC NO. 58080

Ferguson, J. B.

THE EQUILIBRIUM BETWEEN CARBON MONOXIDE, CARBON DIOXIDE, SULFUR DIOXIDE AND FREE SULFUR. *J. Am. Chem. Soc., vol. 40:1626-1644, 1918. 13 refs.*

Carbon monoxide and sulfur dioxide react at temperatures between 1000 and 1200 deg to form carbon dioxide and vapor, with possible traces of carbonyl sulfide in mixtures rich in CO. The equilibrium constants for these temperatures were determined. Calculations were based on the determined values of these constants and the free energy equations for this reaction and for the reaction in which SO2 is formed from its elements. These free energy equations afford a means of calculating many equilibrium conditions, such as between SO2, oxygen, and S, or the equilibrium resulting from the reduction of SO2 at high temperatures by hydrogen.

EFFECTS-HUMAN HEALTH

1974

35328 **APTIC NO. 58128**

Nakamura, Ryuichi

AIR POLLUTION AND NEW-BORN BABIES. *(Taiki osen to shinseiji). Text in Japanese. Sanfujinka Chiryo (Obstet. Gynecol. Ther.), 28(1):24-29, Jan. 1974. 21 refs.*

Following the study of the effects of sulfur dioxide pollution on pregnancy in Yokkaichi, studies on pollution in connection with the fetus, placenta, and stillbirths were made. In Yokkaichi and other cities, significantly higher rates of stillbirths in polluted areas have been noted. Studies of sociological and economic factors show no professional distributions which suggest economic disadvantages of polluted areas. The only correlation that could be found was the well known higher rate of stillbirths among the agricultural population, which was concentrated in non-polluted areas. After 1964 when sulfur dioxide concentration increased in Yokkaichi, stillbirths increased clearly. The frequency of deformed fetuses in polluted area was also noted. The ratio of the weight of placenta to the weight of newborn baby (P/F) in polluted area is greater. The water content of the placenta of women in polluted areas was generally greater than that of women in nonpolluted areas, especially among women with delivery experiences. Atrophic cilia in the placenta in polluted areas was 65% compared to 29% in nonpolluted areas. Fibronoid placentas in polluted areas constituted 35% compared to 21% of nonpolluted areas.

1973

35329 **APTIC NO. 58104**

Adee, R. R. and J. J. Laidler

SUBCELLULAR IDENTIFICATION OF EXOGENOUS PARTICLES BY HIGH-VOLTAGE ELECTRON MICROSCOPY. *Am. Ind. Hyg. Assoc. J., 34(11):507-511, Nov. 1973. 8 refs.*

Hamsters were exposed to aerosols containing either chrysotile asbestos, nickel oxide, or chromic oxide particles. Plutonium (239) oxide particles were suspended in saline and injected intraperitoneally into rats where they were phagocytized by macrophages. Lung tissue or macrophage cells were studied by high voltage electron microscopy (HVEM). Diffraction images and stereopairs of electron micrographs were used to identify and localize specific particles in cells. Numerous Cr2O3 particles were phagocytized by individual pulmonary macrophages. These particles had a plate-like structure compared to the more angular structure of NiO. Plutonium (Pu(239)O2) in sections 1 micron thick was too dense to get a clean diffraction pattern; but acceptable patterns could be obtained in 0.3 micron sections. With HVEM, chemical forms of the elements can be identified on particles as small as 20 nm, thus making it possible to identify some specific components of inhaled pollutants. With HVEM, sections 1 micron thick can be studied in stereopairs, thus revealing in three dimensions the structure of the particulates and their relationship to the cell surface and to intracellular organells. However, sometimes a compromise on specimen thickness is necessary, as in the case of plutonium particles.

35330 **APTIC NO. 58105**

Cohen, Harvey J., Robert T. Drew, Jean L. Johnson, and K. V. Rajagopalan

MOLECULAR BASIS OF THE BIOLOGICAL FUNCTION OF MOLYBDENUM. THE RELATIONSHIP BETWEEN SULFITE OXIDASE AND THE ACUTE TOXICITY OF BISULFITE AND SO2. *Proc. Nat. Acad. Sci. U. S., 70(12):3655-3659, Dec. 1973. 26 refs.*

The administration of tungsten to rats maintained on a low molybdenum diet resulted in a dose and time-dependent loss of sulfite oxidase and xanthine oxidase activities and hepatic molybdenum. The tungsten-treated animals appeared healthy, but were more susceptible to bisulfite toxicity. The median lethal dose for intrapertoneal bisulfite was 181 mg of sodium bisulfite per kg for the animals deficient in sulfite oxidase, compared to 473 mg/kg for normal rats. The survival time for rats exposed to sulfur dioxide at concentrations of 590 ppm and higher was inversely related to the level of SO2. At 590 and 925 ppm, control animals displayed symptoms of severe respiratory toxicity before death. At 2350 ppm of SO2, death was preceded by seizures and prostration, symptoms observed with the systemic toxicity of injected bisulfite. At 590 ppm, animals deficient in sulfite oxidase were indistinguishable from control animals. Hovever, at 925 ppm and 2350 ppm, the deficient animals displayed symptoms of systemic toxicity and had much shorter survival times. Sulfite oxidase was thus instrumental in counteracting the toxic effects of bisulfite, either injected or derived from respired SO2. Respiratory death probably resulted from the toxicity of gaseous SO2 before absorption as bisulfite and cannot be alleviated by sulfite oxidase. Sulfite oxidase did not appear to be inducible by either bisulfite or SO2. (Author abstract)

35331 **APTIC NO. 55434**

Corbett, T. H., R. G. Cornell, J. L. Endres, and R. I. Millard

EFFECTS OF LOW CONCENTRATIONS OF NITROUS OXIDE ON RAT PREGNANCY. *Anesthesiology, 39(3):299-301, Sept. 1973. 4 refs.*

The effects of low concentrations of nitrous oxide on pregnant rats were investigated. The concentrations were similar to those present in the operating room during routine occupational exposure for various periods during pregnancy. The rats exposed to 15,000 ppm and 1000 ppm for 24 hr/day had fetal death rates and pregnancies/rat ratios which were significantly different from the controls. Two groups exposed to 1000 ppm for 8 hr/day also had fetal death rates significantly different from the controls. Exposure for 8 hr/day did not significantly alter the pregnancies/rat ratios. Differences in the fetal death rates between groups exposed from 6 am to 2 pm and from 2 pm to 10 pm suggest a diurnal variation in the embryotoxic effect of N2O in the rat. Caution in interpreting this data in relation to human pregnancy is recommended. This study demonstrated the need for extensive testing of chronic exposure to low concentrations of inhalation anesthetic agents for possible embryotoxic, teratogenic, mutagenic, and carcinogenic effects. (Author abstract modified)

35332 **APTIC NO. 58107**

Gardner, M. J.

USING THE ENVIRONMENT TO EXPLAIN AND PREDICT MORTALITY. *J. Roy. Stat. Soc., 136(3):421-440, 1973. 31 refs.*

Mortality at ages 45-74 was studied in the larger County Boroughs of England and Wales. In the younger segment of this span of years, premature mortality and morbidity from the chronic diseases is widespread. Although this study does not look at inherited predisposition or individual behavior habits, the socio-environmental patterns are described for the major causes of death. Large differences in death rates still persist between towns in this country, and are related to environment. Multiple regression methods form the basis of the analysis of the large data bank collected for this purpose. The socio-environmental variables are shown to be differently related to different causes of death, and in some cases a very high proportion of the variance of death rates between towns is explained. An examination of the effectiveness of these equations in predicting the mortality in a further set of towns not included in the initial analysis is discussed. This is considered in relation to a theoretical result showing how well an estimated regression line can be expected to perform in a second independent set of data. Although the multiple regression model is almost certainly not correct in this situation, the results fit closely. The problems of interpreting the regression coefficients when the regressor variables are highly intercorrelated, and some guidance in the particular situation are discussed. (Author abstract)

35333 APTIC NO. 58222

Hammer, Douglas I., Victor Hasselblad, Bernard Portnoy, and Paul F. Wehrle

THE LOS ANGELES STUDENT NURSE STUDY: DAILY SYMPTOM REPORTING AND PHOTOCHEMICAL OXIDANTS. *Preprint, Environmental Protection Agency, Research Triangle Park, N. C., National Environmental Research Center, and University of Southern California, Los Angeles, Medical Center, 28p., 1973. 40 refs.*

The daily reporting of headache, eye discomfort, cough, and chest discomfort among Los Angeles student nurses exposed to ambient, short term elevations of photochemical oxidants was analyzed. Average daily symptom rates were compared to daily pollutant data recorded at a nearby monitoring station. Eye discomfort, cough, and chest discomfort increased with maximum hourly oxidant levels. Headache increased when symptoms were adjusted for intercurrent morbidity. The relative increase of adjusted symptoms on highest oxidant days (greater than or equal to 40 ppm) ranged from 1.4 for headache to 6.1 for eye discomfort. Temperature, carbon monoxide, and nitrogen dioxide did not explain these associations. Cigarette smoking, a history of allergies, or bias in symptom reporting were not likely confounding factors. Heacache and eye discomfort frequently interfered with work and personal habits. Excess cough and chest discomfort attributable to oxidant exposure may easily impose additional physiological hardships upon high risk population subgroups. (Author abstract modified)

35334 APTIC NO. 58148

Henry, M. C. and D. G. Kaufman

CLEARANCE OF BENZO(A)PYRENE FROM HAMSTER LUNGS AFTER ADMINISTRATION ON COATED PARTICLES. *J. Nat. Cancer Inst., 51(6):1961-1964, Dec. 1973. 17 refs.*

The persistence of benzo(a)pyrene in the respiratory tract of hamsters was determined after intratracheal instillation of the particulate dusts carbon, aluminum oxide, and ferric oxide (in the size ranges of 0.5-1, 2-5, 5-10, and 15-30 micron), each coated with benzo(a)pyrene. Because the 2% dust/2% carcinogen preparations were prepared on a weight basis, density differences required that more particles of carbon than of aluminum oxide or ferric oxide be given. Analysis of the benzo(a)pyrene content of the lungs immediately after instillation showed that the carbon preparation contained more carcinogen. The benzo(a)pyrene was cleared much more slowly from lungs of carbon-treated animals, and there was a positive correlation between particle size and retention rate. The aluminum oxide and ferric oxide particles retarded the clearance of the carcinogen, but retention rates did not correlate with particle size. These results are discussed in relation to the pathogenesis of lung cancer in hamsters treated by intratracheal instillations. (Author abstract)

35335 APTIC NO. 58272

Kuller, Lewis H., Edward Radford, David Swift, Joshua Perper, and Russell Fisher

THE RELATIONSHIP BETWEEN AMBIENT CARBON MONOXIDE LEVELS, POSTMORTEM CARBOXYHEMOGLOBIN SUDDEN DEATH AND MYOCARDIAL INFARCTION. *Johns Hopkins School of Hygiene and Public Health, Dept. of Epidemiology and Environmental Medicine; Maryland State Office of the Chief Medical Examiner; and Pittsburgh Univ., Pa., Dept. of Epidemiology, Environmental Protection Agency Contract 68-02-0082, Coordinating Research Council APRAC Proj. CAPM 13-69, National Inst. of Health Contract 72-2071, 16p., 1973. (Presented at the American Heart Association, Annual Meeting, Nov. 8, 1973.)*

An epidemiological study was carried out to determine whether ambient carbon monoxide levels in a large urban area were an important precipitant of sudden cardiac death and myocardial infarction. The study included sudden death and myocardial infarction patients in the Baltimore City area, a pathological study of sudden death, air pollution monitoring, analysis of postmortem blood specimens, collection of histories of sudden death patients, carboxyhemoglobin levels and smoking histories obtained from controls, and measurement of carboxyhemoglobin levels in patients having suspected heart attack. There was no evidence of clustering of deaths or infarctions, or of association between ambient CO levels and cardiovascular disease. Slightly higher carboxyhemoglobin levels in sudden death cases could have been explained by variations in smoking habits. Most deaths connected with high carboxyhemoglobin levels (greater than 10) were due to fires or suicides by CO. Carboxyhemoglobin levels were substantially higher for cigarette smokers than nonsmokers. The results did not support the hypothesis that ambient CO levels were major factors in the onset of sudden death or myocardial infarction.

35336 APTIC NO. 58106

Mordelet-Dambrine, Madeleine, Maurice Stupfel, Francoise Romary, and Jean-Louis Parrot

COMPARATIVE STUDY OF THE EFFECT OF CARBON MONOXIDE AND HYPOXIA ON THE BRONCHIAL MOTILITY IN ANESTHETIZED GUINEA PIGS. *(Etude comparative des effets de l oxyde de carbone et de l hypoxie sur la bronchomoticite du cobaya anesthesie). Text in French. Arch. Int. Physiol. Biochem., 81(4):673-688, Oct. 1973. 24 refs.*

The total ventilatory resistance was studied with a modification of Konzett-Rossler s method on anesthetized guinea pigs inhaling mixtures of air containing from 0.05-5% carbon monoxide and hypoxic mixtures containing from 10-0% oxygen in nitrogen. A bronchospasm resulted from the inhalation of these two types of hypoxic mixtures, in more than 60% of the experiments. There was no direct relationship between the bronchospasm and the concentration of inhaled CO, but there was one relationship between the bronchospasm and the concentration of oxygen in nitrogen. The time between the inhalation of the gaseous mixture and the bronchospasm was about four times longer when the guinea pig breathed the different mixtures of CO, than when it breathed the gaseous mixtures of O_2 in N_2. Both types of mixtures inhibited the bronchospasm obtained by histamine intravenously injected. In most experiments, the blood pressure decreased. When the values obtained for 5% CO and pure N_2 were dismissed, the blood pressure decreased from 6 to 23% for inhalation of the different mixtures of carbon monoxide, and from 13 to 47% for inhalation of the different concentrations of O_2 diluted in N_2. This blood pressure diminution did not appear to be in direct relationship with the degree of hypoxia.

35337 **APTIC NO. 57792**

Schneider, Norman R. and Roger A. Yeary

MEASUREMENT OF NITRITE AND NITRATE IN BLOOD. *Am. J. Vet. Res., 34(1):133-135, Jan. 1973. 18 refs.*

Methods and materials for the measurement of nitrite and nitrate in blood which yield highly accurate and consistently reproducible results are presented in detail. Samples must be centrifuged within 15 min after blood is collected because of the in vitro oxidation of nitrite by erythrocytes. Mercuric chloride is the preferred protein precipitant because it produces a crystal clear supernatant without loss of nitrite, does not inhibit color formation, and is more expedient than barium chloride and cadmium chloride extraction; addition of sodium carbonate, however, is necessary to precipitate the excess mercury. Traces of mercury which might remain after the precipitation do not affect the efficiency of the cadmium reduction column used. The lower range of sensitivity that can be achieved is 0.1 microgram of NO2 anion/ml or an equimolar quantity of nitrate.

35338 **APTIC NO. 58156**

Suetsugu, Susumu

CONTROL OF DAILY LIFE AND REHABILITATION OF PATIENTS WITH CHRONIC BRONCHITIS. *Mansei kikanshien). Text in Japanese. Hai to Shin (Lung Heart), 20(3):159-163, Sept. 1973.*

As part of the treatment of chronic bronchitis, elimination of environmental factors, prevention of infection, physical treatment and rehabilitation therapies, the use of nebulizers, breathing exercises, medical care, and the daily rehabilitation program are discussed. Much of chronic bronchitis is either caused or enhanced by air pollution. The relocation of patients from the polluted area to a less polluted area, an area with mild climate and clean air is desirable. Those working in an environment with dusts and irritant gas should definitely change their jobs or at least move to another work area. The drastic change of the atmospheric temperature, especially contact with drastically cold air, promotes inflammation of the respiratory mucous membrane. High temperatures in the room in winter should be avoided; the use of a mask for going out is effective in avoiding the cole air. Smoking should be strictly avoided, since it is known to cause chronic bronchitis, chronic emphysema, extreme swelling of bronchial mucous membranes, increase of mucous discharge, obstruction of cilia, and increase of pulmonary resistance.

35339 **APTIC NO. 58188**

Tierney, Donald, Larry Ayers, Suzanne Herzog, and Josephine Yang

PENTOSE PATHWAY AND PRODUCTION OF REDUCED NICOTINAMIDE ADENINE DINUCLEOTIDE PHOSPHATE. *Am. Rev. Respirat. Disease, 108(6):1348- 1351, Dec. 1973. 9 refs.*

Glucose-6-phosphate dehydrogenase activity in rat and mouse lungs was related to their tolerance to oxygen exposure. Adult rats that were exposed to 85% O2 at 1 atm pressure became tolerant to 99% O2 and developed an increased glucose-6-phosphate dehydrogenase activity, whereas a strain of mice that did not develop oxygen tolerance by previous exposure to 85% O2 did not develop increased glucose-6-phosphate dehydrogenase activity. Glucose-6-phosphate dehydrogenase is a key enzyme in the pentose pathway, and it has been proposed that reduced nicotinamide adenine dinucleotide phosphate produced from this pathway might reflect, in part, the capacity of the lung to tolerate oxygen exposure. The increased activity of this enzyme may relate to reduction of oxidants, to an increased capacity to synthesize injured cell components, or to the capacity of lung cells to proliferate and replace injured cells. (Author abstract)

35340 **APTIC NO. 58246**

Public Health Service, Washington, D. C., National Inst. for Occupational Safety and Health

CRITERIA FOR A RECOMMENDED STANDARD .... OCCUPATIONAL EXPOSURE TO COKE OVEN EMISSIONS. (FINAL REPORT). *HSM 73-11016, 60p., 1973. 63 refs.*

GPO

Operating procedures, work practices, and respiratory protection measures are outlined for worker protection during the coking of coal; and biological effects of exposure to coal are reviewed in terms of historical reports, epidemiological studies, and animal toxicity investigations. The seriousness of the diseases associated with exposure to coke oven emissions makes prompt reduction of occupational exposures to the lowest practicable level important until information on which to establish a safe environmental level becomes available. There is some evidence that exposure to such emissions may be associated with an increased occurrence of bronchitis, and evidence from countries other than the United States clearly indicates that workers intimately exposed to the products from the carbonization of coal experience increased mortality due to cancer of the skin, lung, bladder, and kidney. Benzo(a)pyrene, a chemical carcinogen frequently used for the experimental induction of cancer, has been identified as one of several carcinogenic constituents of coal tar.

1972

35341 **APTIC NO. 55557**

Brunori, Maurizio, Joseph Bonaventura, Celia Bonaventura, Eraldo Antonini, and Jeffries Wyman

CARBON MONOXIDE BINDING BY HEMOGLOBIN AND MYOGLOBIN UNDER PHOTODISSOCIATING CONDITIONS. *Proc. Nat. Acad. Sci., 69(4):868-871, April 1972. 13 refs.*

Carbon monoxide binding by myoglobin and hemoglobin was studied under conditions of constant illumination. For hemoglobin, the homotropic heme-heme interaction (cooperatively) and the heterotropic Bohr effect are invariant with light intensity over a 1000-fold change of c 1/2. The dissociation constant, measured as c 1/2, increases linearly with light intensity, indicating that photodissociation is a one-quantum process. At sufficiently high illumination, the apparent enthalpy of ligand binding becomes positive, although in the absence of light it is known to be negative. This finding indicates that light acts primarily by increasing the off constants by an additive factor. The invariance of both cooperativity and Bohr effect raises a perplexing issue. It would appear to demand either that the off constants for the various elementary steps are all alike (which is contrary to current ideas) or that the additive factor is, in each case, proportional to the particular off constant to which it is added. (Author abstract)

35342 **APTIC NO. 58162**

Luciak, Mieczyslaw, Stanislaw Kosmider, and Marian Drozdz

INFLUENCE OF EXHAUST COMBUSTION GASES ON THE MYOCARDIUM AND BLOOD VESSELS. *(Wplyw odlotowych gazow spalinowych na miesien serca i naczynia drwionosne). Text in Polish. Patol. Polska (Warsaw), 23(4):461-470, 1972. 13 refs.*

The influence of combustion exhaust gases on the vascular walls and the myocardium was examined. Disorders were observed in the acid-base balance and the lipid-carbohydrate metabolism, and exposure to such gases resulted in respiratory acidosis and damage to the vascular walls and myocardium.

35343 APTIC NO. 58971

Wehner, Alfred P. and Douglas K. Craig

TOXICOLOGY OF INHALED NIO AND COO IN SYRIAN GOLDEN HAMSTERS. *Am. Ind. Hyg. Assoc. J., 1972:146-155, March 1972. 7 refs.*

Syrian golden hamsters exposed in several manners from 3-7 hr/day for up to 60 days to the inhalation of nickelous oxide (10-190 microgram/l) and cobaltous oxide (2-160 microgram/l) showed completely different behavior in response to these two compounds. Nearly 20% of the inhaled NiO was retained in the lungs after initial clearance, and 45% of this was still present after 45 days. Comparable figures for CoO were less than 1% after initial clearance and none after 6 days. No hamster exposed to NiO at any concentration died before scheduled sacrifice within 6 months postexposure. All of the hamsters exposed to CoO at 106 microgram/l died by the fourth of the 3-hour exposures. (Author abstract modified)

1971

35344 APTIC NO. 57808

Buesser, E., F. Dorschner, and A. A. Buehlmann

ON THE EARLY DIAGNOSIS OF ASB STOSIS. *(Zur Fruehdiagnose der Asbestose). Text in German. Schweiz. Med. Wochenschr., 101(47):1687-1692, Nov. 27, 1971. 17 refs.*

Chest x-ray, vital capacity, one-second vital capacity, and lung compliance tests have been used for several years in the diagnosis of asbestosis among some one hundred asbestos workers. Dust vital capacity and compliance decrease progressively during intense exposure, while radiological changes develop rather slowly. Frequency of dyspnea has been related to a decrease of vital capacity. The presence of decreased vital capacity and compliance, in combination with slight changes in the x-ray, has proven to be an indicator of the early phase of asbestosis.

35345 APTIC NO. 57786

Dost, Frank N., Donald J. Reed, Arthur Finch, and Chih H. Wang

TOXICITY OF TETRAFLUOROHYDRAZINE. *Toxicol. Appl. Pharmacol., 18(4):766-772, April 1971. 12 refs.*

Inhalation and injection exposure studies were performed with male Sprague-Dawley rats to examine the toxicity and decomposition chemistry of tetrafluorohydrazine. Inhalation exposure to 10,000 ppm N2F4 for 25 min or more proved lethal; and such concentrations, in the absence of decomposition prior to inhalation, caused oxidation of as much as 65% of the total hemoglobin to methemoglobin. Decomposed N2F4 was approximately as lethal as nondecomposed N2F4 but resulted in only moderate formation of methemoglobin. Principal degradation products resulting from intact N2F4 in the atmosphere were identified as nitric oxide and hydrogen fluoride; nitrogen dioxide accumulated with the disappearance of N2F4. Results of the inhalation and injection studies suggested that N2F4 mortality can not be necessarily attributed to the effect of methemoglobin levels. (Author abstract modified)

35346 APTIC NO. 58229

Gabriel, Karl L.

THE OCCUPATIONAL ENVIRONMENT. *In: Environmental Health. P. Walton Purdom (ed.), New York, Academic Press, 1971, Chapt. 9, p. 431-482.*

The recognition and control of health hazards in the occupational environment are discussed. The occupational environment can be evaluated through surveys and sampling of the atmosphere. Descriptive and operational definitions of the concept of toxicity are presented including: development of threshold limits for air, bases and definition of threshold limit values for air, sampling and analysis of gases and vapors, and sampling for dust. The causes and prevention of occupational dermatoses are discussed including engineering and personal hygiene methods of control. The control of occupational exposures to injurious materials or conditions may be accomplished by substitution of less toxic materials, or change of process; isolation or enclosure of operations or machinery; control at point of generation or dissemination; dilution with uncontaminated air; personal protective equipment; and maintenance, housekeeping, and education. Pneumoconiosis diseases are described.

35347 APTIC NO. 57867

Ilic, V. and K. Popovic

METAL FUME FEVER. *(Cinkova groznica). Arhiv. Hig. Rada. Toksikol. (Yugoslavia), vol. 22:359-364, 1971. 11 refs. Translated from Serbo-Croatian, 8p.*

Two cases of zinc fume poisoning are presented, along with a review of the etiology, clinical form, and therapy for this affliction. Both patients had been working with galvanized materials (cutting or welding) and had not worn protective masks. Symptoms of temperature, chills, shaking, pain, weariness, and vomiting, typical of Zn poisoning, were observed upon admittance to the clinic, and laboratory findings of high leukocyte counts confirmed the diagnosis. The large number of leukocytes in one of the cases was diagnosed as resulting from a condition of hemoblastosis rather than Zn fume poisoning, however. Zinc in the serum was not determinable in either case.

35348 APTIC NO. 58233

Kahanpaa, Asko

BRONCHOPULMONARY OCCURRENCE OF FUNGI IN ADULTS. ESPECIALLY ACCORDING TO CULTIVATION MATERIAL. *Preprint, Helsinki Univ. (Finland), Dept. of Serology and Bacteriology, 146p., 1971. 811 refs. (Acta Pathologica et Microbiologica Scandinavica, Supplement 227 to Section B, 1972.)*

The bronchopulmonary occurrence of fungi in the adult population in Finland was investigated particularly in patients with pulmonary disease. Fungal cultures were made of 8290 specimens, of which 5280 were from the bronchopulmonary area. A total of 4539 yeast strains, belonging to 41 identified species, were isolated from the respiratory tract specimens. The fungus most frequently isolated from the bronchopulmonary specimens was Candida albicans. Its incidence in morning sputum varied between about 60 and 70% in the different groups studied. The most commonly encountered filamentous fungus, Aspergillus fumigatus, had an incidence of 2-3% in sputa and bronchial secretions of pulmonary disease patients. Differences in the incidences of occurrence of fungi were seen between age groups, rather than sex, and growth of at least certain species of fungi apparently were more general in elderly persons. A detailed model for performance of fungal cultures from bronchopulmonary specimens is presented. (Author summary modified)

35349 APTIC NO. 57791

Kinkead, E. R., U. C. Pozzani, D. L. Geary, and C. P. Carpenter

THE MAMMALIAN TOXICITY OF DICYCLOPENTADIENE. *Toxicol. Appl. Pharmacol., 20(4):552-561, Dec. 1971. 5 refs.*

Mammalian toxicity studies and human sensory response studies were performed to assess the danger of dicyclopentadiene, a cyclic diene employed extensively throughout industry. The LC50 values for single 4-hour vapor inhalation periods varied from 771 ppm for male rabbits to 145 ppm for male mice. Human sensory response studies revealed a detection threshold of 0.003 ppm, i.e., a very good warning threshold. The response of rats and dogs to repeated 7-hour exposures of the vapor for 89 days suggested that man should not be allowed to inhale more than 5 ppm during an 8-hour working day, 5 days/wk, pending additional human experience data. (Author abstract modified)

35350 **APTIC NO. 57693**

Neshkov, N. S.

THE EFFECT OF CHRONIC INTOXICATION WITH ETHYL GASOLINE ON SPERMATOGENESIS AND SEXUAL FUNCTION OF MALES. *(Vliyanie chronicheskoy intoksikacyi etilirovanym benzinom na spermatogenez i polovuyu funkcyu mushcin). Gigiena Truda i Prof. Zabolevaniya, vol. 15:45-46, 1971. 9 refs. Translated from Russian, 5p.*

Spermatogram tests, viscidity and time required for rarefaction of sperm, and sperm pH were evaluated for 66 patients suffering from chronic intoxication with ethyl gasoline in order to study the effect of tetraethyl lead on spermatogenesis. Decrease in the volume of ejaculant (less than 2 ml) was observed in 23 patients; increase in viscidity occurred in 28 patients; and a tendency toward lengthening of the time for rarefaction occurred in 32 of the patients. The number of spermatozoa in one ml was below norm in 44 of the patients, and the number of motionless spermatozoa reached nearly 20%. Morphologically changed mature spermatozoa were diagnosed in six patients. The content of 17-ketosteroids in urine was decreased to 6.2 mg/24 hr in 16 patients. Tetraethyl lead exercises a toxic effect not only on neuro-regulatory mechanisms of sexual function but also on spermatogenesis.

35351 **APTIC NO. 57790**

Schepers, Gerrit W. H.

LUNG TUMORS OF PRIMATES AND RODENTS. PART III. *Ind. Med. Surg. 40(3):8-26, June 1971.*

Histological results are reviewed for 269 industrially-induced human lung cancers and 276 pulmonary neoplasmata which developed in monkeys, rabbits, guinea pigs, and rats after inhalation exposure or intratracheal injection of 266 aerosol substances. Animal tumors developed in 10,768 cases; whereas 4143 control animals, matched for sex, age, and survival, showed no tumors. Large numbers of lesions that were judged to be pre-neoplastic were observed in addition to neoplasia. A paucity of mesodermoid lesions were noted for animals as compared to humans; and animal tumors arose in the pulmonary parenchyma, whereas primary human lung tumors were frequently located in the bronchi. No morphological separation between benignity and malignity of the animal tumors could be established. (Author abstract modified)

35352 **APTIC NO. 57778**

National Inst. of Health, Bethesda, Md., John E. Fogarty
International Center for Advanced Study in the Health
Sciences and National Inst. of Environmental Health
Sciences, Research Triangle Park, N. C.

FOGARTY INTERNATIONAL CENTER CONFERENCE REPORT: MUTAGENIC EFFECTS OF ENVIRONMENTAL CONTAMINANTS. *Dep. of Health, Education, and Welfare Rept. (NIH) 72-65, 20p., March 1971.*

The mutagenic effects of several environmental contaminats are considered by examining the current burden of human genetic disease; the biochemical mechanisms of mutation; the practical and feasible tests, using a variety of organisms, for screening potential mutagenic agents; methods of determining the human mutation rate; a catalog of mutagens which are currently in use commercially; and the possible interrelationships between mutagenesis, carcinogenesis, and teratogenesis. Known mutagens covered include: pesticides, herbicides, sodium nitrite, nitrosamines, alkylating agents, ethylene oxide, acrolein and formaldehyde.

1970

35353 **APTIC NO. 57798**

Mudd, J. Brian

EFFECTS OF ENVIRONMENTAL AGENTS AT THE ENZYME LEVEL - AIR POLLUTANTS. *In: Physiology, Environment, and Man, D. H. K. Lee and D. Minard, (eds.), New York and London, Academic Press, 1970, p. 59-60. 5 refs.*

The action of peroxyacetyl nitrate, and end product of a series of reactions occurring when nitrogen oxides and oxygen are irradiated in the presence of hydrocarbons, is considered at the enzyme level. The three possible toxic modes are: oxidation due to the peroxidic character, acetylation due to the anhydride character, and liberation of nitrite on hydrolysis; susceptible chemical targets close to the portal of entry in the lungs are most likely to be affected. Nicotinamide nucleotide are readily oxidized by PAN, and energy-producing reactions, normally mediated by nicotinamide adenine dinucleotide in the cytochrome system, would be expected to the impared. Clucose-6-phosphate dehydrogenase is inactivated by PAN and is protected by nicotinamide adenine dinucleotide phosphate, but it is not protected by glucose-6-phosphate. Isocritrate dehydrogenase is protected by both NADP and isocitrate, while malate dehydrogenase is protected by neither NAD nor malate. These differences are similar to inhibition by sulfhydryl reagents and indicate than PAN inactivates enzymes by reaction with the sulfhydryl group. Sulfhydryl groups of proteins, however, are relatively inaccessible, and there is steric difficulty in forming disulfide bonds. The reaction of PAN with sulfhydryl groups produces disulfides, S-acetyl compounds, and sulfoxides, and these reactions inactivate enzymes which require free sulfhydryl groups for activity. Conversion of protein sulfhydryl groups to disulfides and S-acetyl compounds may be reversible to disulfide reductases and thioesterases.

35354 **APTIC NO. 55504**

Norseth, Tor and Knut Naess

THE COMPLICATED TOXICOLOGICAL SITUATION. LEAD AND CADMIUM. TWO SNAPSHOTS WITH COMMENTS. *(Den kompliserte toksikologiske situasjon. Bly og kadmium. To sma oyeblikksbilder med kommentarer). Text in Norwegian. Tidsskr. Norske Laegeforen, 90(16):1529-1531, Aug. 1970.*

Problems of chronic poisoning with lead and cadmium are discussed. Blood lead contents of 5-25 micrograms/100 ml and 11-94 micrograms/100 ml, respectively, were measured in normal and occupationally exposed populations. Inhibition of the erythrocyte delta-aminolevulinic acid dehydrogenase due to blood lead concentrations as low as 5-15 micrograms/100 ml was noted. On the other hand, blood lead concentrations up to 70-80 micrograms/100 ml are commonly believed to be harmless. Urine coproporphyrine and delta-aminolevulinic acid analyses are commonly used for the quantitative determination of the degree of exposure to lead. Cadmium, which is practically nonexistant in newborn children, gradually increases in the human organism, and especially in the kidney, until the age of 50, to decrease thereafter. The daily cadmium intake in civilized populations may range from 200 to 400 micrograms. While small concentrations of cadmium, e.g., 5 micrograms/ml in drinking water, cause hypertension, high concentrations have opposite effect. Cadmium has strong affinity with the SH-groups.

35355 **APTIC NO. 58275**

Shy, Carl M.

KEYNOTE PAPER. *Air Pollution Control Assoc., Pittsburgh, Pa., Proc. Air Pollution Control Assoc., Mid-Atlantic States Sect., Semi-Annu. Tech. Conf. Transp. Impact Air Pollut., Harrisburg, Pa., 1970, p. 7-25. (Oct. 8-9.)*

Carbon monoxide can cause atherosclerosis, cardiovascular response, and other diseases. An epidemiological study of the effect of CO on myocardial infarction or heart attacks is mentioned. Ozone can cause acute toxic effects at doses close to the ambient level of exposure. Such effects include chest pain in humans exercising, accumulation of alveolar protein in animals, reduction of resistance to infection, changes similar to bronchitis and emphysema in animals, and increased tumor incidence. Nitrogen dioxide is similar to ozone in that it is an oxidant. It also causes reduced resistance to infection and increased respiratory disease incidences. Acute and chronic lead effects are discussed. The relative toxicity of CO, O3, NO2, and sulfur dioxide are reviewed. Epidemiological and laboratory studies of these toxic pollutants are reviewed. Questions and answers are included.

1969

35356 APTIC NO. 57075

Achten, G. and J. Oleffe

HISTOPATHOGENIC STUDY OF CONTACT ECZEMA. ITS PRACTICAL APPLICATIONS FOR ECZEMA FROM CEMENT. *(Etude histopathogenique de l eczema de contact. Ses applications pratiques a l eczema du ciment). Ann. Dermatol. Syphiligr., 96(5-6):501-516, 1969. 57 refs. Translated from French, 25p.*

An analysis and synthesis of histopathogenic data derived from human and animal eczema studies relating to contact with chromium-bearing cement are presented along with some theoretical measures which might be useful in combatting cement-induced dermatitis. The histopathogenic course of the chromium-induced eczema can be divided into three stages: penetration of the chromium antigen and transport toward the site of antibody formation; antibody formation; and antibody transport and terminal reaction in the skin. One theoretical possibility for reducing the incidence of eczema from cement based on the above scheme would be suppression of the formation of antibodies formed, though the use of immuno-suppressants in the strict sense should not be taken into consideration at the present level of knowledge. Desensitization is another possibility; potassium bichromate has been successfully used in animal experiments to create an immune state to the skin disease. Animal studies also have pointed to the possibility of genetic predisposal; and this factor may ultimately have to be taken into consideration from an occupational standpoint. Presently, local protection in the form of gloves, silicone-based creams, soaps, and acid salves is available. Attention should also be given to research already performed towards neutralizing the chromium in cement by chelators and by precipitative inactivation in the form of insoluble salts.

35357 APTIC NO. 58198

Barltrop, Donald

ENVIRONMENTAL LEAD AND ITS PAEDIATRIC SIGNIFICANCE. *Postgrad. Med. J. (London), 45(520):129-134, Feb. 1969. 61 refs.*

Appreciable body burdens of stable and radioactive lead may be acquired by children, and part of the maternal intake of lead may influence the fetus. The industrial contribution to environmental lead may result from the emission of lead particles into the atmosphere and by pollution of natural waters with lead-containing industrial effluents. In areas close to lead smelters or installations for the burning and distillation of coal, significant atmospheric pollution can occur. After combustion, the antiknock derivatives in gasoline are released as a mixture of halides and oxides, polluting the air and contaminating nearby vegetables and reservoirs. The blood lead of persons living close to regions of high traffic density is significantly higher than that of comparable individuals in areas remote from heavy traffic. Radioactive lead is continuously deposited on the earth s surface as part of the natural fallout, although it is increased after atmospheric nuclear detonations. Inasmuch as the body cannot distinguish radioactive from stable lead, and since this is a bone-seeking element, the situation is analogous to strontium-90. There is a close correlation between the SR-90 and the radioactive lead content of human bones. The use of lead-containing pesticides is another harmful practice. The rapid growth rate, immature metabolic apparatus, and different dietary patterns which characterize the pediatric age groups suggest that standards for adult males might not be applicable.

35358 APTIC NO. 57824

Dungworth, D. L., G. L. Clarke, and R. L. Plata

PULMONARY LESIONS PRODUCED IN A-STRAIN MICE BY LONG-TERM EXPOSURE TO PEROXYACETYL NITRATE. *Am. Rev. Respirat. Disease, 99(4):565- 574, 1969. 28 refs.*

Exposure of male mice, strain A, to 15 ppm of peroxyacetyl nitrate for 130 daily 6-hour periods over the course of 6 mo caused weight loss and 18% mortality, the latter primarily by predisposition to severe exudative bronchopneumonia of bacterial origin. Uncomplicated lesions produced by peroxyacetyl nitrate consisted essentially of chronic hyperplastic tracheobronchitis, bronchiolitis, and pneumonitis. There were metaplastic epithelial changes, the nature of which varied with the level of respiratory tract involvement. The most noteworthy feature of the bronchial response was the formation of acinar structures within the walls, occasionally with superimposed atypical epithelial changes. Foci of squamous metaplasia were observed in the trachea and mainstem bronchi in approximately 50% of the mice. Peribronchial epithelial hyperplasia was prominent, but adenomas were not produced during the course of the study. Additional components of the response to peroxyacetyl nitrate were bronchiolectasis and patchy, mild, centriacinar emphysema. (Author summary)

35359 APTIC NO. 58857

Lawther, P. J., T. R. Emerson, and F. W. O Grady

HAEMOPHILUS INFLUENZAE: GROWTH STIMULATION BY ATMOSPHERIC POLLUTANTS. *Brit. J. Diseases Chest (London), 68(1):45-47, Jan. 1969. 3 refs.*

The effects of particulate pollutants on the growth of some organisms found in the respiratory tract were investigated to determine the relationship between air pollution and bronchitis. The bacteria were spread on blood agar plates and either wells were made in the agar where aqueous extracts of the pollutants were placed, or the pollutants in the solid state were sprinkled onto the plates. Most of the extracts inhibited the growth of Haemophilus influenzae. In the experiments with certain extracts, such as phenol in water, it was noted that at the periphery of the inhibition zone surrounding the wells, growth was stimulated. These findings may have an important bearing on the causes of chronic bronchitis.

35360 APTIC NO. 57978

Rylander, Ragnar

MEDICAL-HYGIENIC PROBLEMS IN POLITICS RELATED TO PROTECTION OF TODAY S ENVIRONMENT. *(Medicinskt-hygieniska problem i dagens miljovardspolitik). Text in Swedish. Lakartidningen, 66(6):549-556, Feb. 1969. 6 refs.*

Presented are definitions, examples, and studies concerning the medical effects on humans of exposure to air and water pollution. Discussed are environment, current problems, epidemiologic methods, experimental animals studies, sociological studies, and establishment of norms. Present problems of water pollution have been studied in Norrkoping, a city with two water systems and different concentrations of fluoride. The degree of air pollution depends partly on meteorological conditions. With moderate winds and a temperature decrease of 1 C per hundred meters of elevation, pollution may not be dangerous. However, under stable conditions and temperature inversion, warm industrial fumes cannot rise. Results may be serious, with acute diseases and death. Tar in the air from industrial and forestry operations has a carcinogenic effect which may not appear for 15-30 years. To establish the presence of medical effects of pollutants, large experimental populations are required. And, even with large populations, some effects may remain undetected. Maximum safe concentrations of sulfur dioxide in the air have been put at 5 ppm in an average workday, 5 pphm in an average month, 10 pphm in an average 24-hour day, and 25 pphm in any 30-minute period.

35361 APTIC NO. 57863

Ventura, Joaquin C. and Maria Domaradski

PULMONARY EFFECTS OF NITROUS DIOXIDE IN THE HYPERSENSITIVE GUINEA PIG. *Ann. Allergy, 27(3):100-107, March 1969. 15 refs. (Presented at the Canadian Association of Pathologists, Annual Congress, 20th, Banff, Alberta, June 1968.)*

Repeated exposure of hypersensitive guinea pigs to nitrous dioxide gas resulted in hypersecretion of bronchial mucus. Neither nonsensitized animals that were exposed to the inhalation of the gas nor sensitized unexposed animals showed significant bronchial epithelial changes. Sensitized animals exposed to repeated doses of inhaled antigen in a chamber developed a significant increase in the number of bronchial goblet cells. Heart and lung changes were noted. An increased immunologic sensitivity of the bronchial mucosa following exposure to irritants, such as nitrous dioxide gas may produce mucus hypersecretion in man. This hyperactivity of the bronchial epithelium to air pollutants may cause the bronchial tree to develop chain sustained mucus hypersecretion and irreversible bronchial obstruction.

35362 APTIC NO. 57834

Weill, Hans, Ronald George, Marvin Schwarz, and Morton Ziskind

LATE EVALUATION OF PULMONARY FUNCTION AFTER ACUTE EXPOSURE TO CHLORINE GAS. *Am. Rev. Respirat. Disease, 99(3):375-379, March 1969. 15 refs.*

Pulmonary function was assessed in 12 subjects, 3 and 7 years after acute, accidental, heavy exposure to chlorine gas. No appreciable physiologic disorders were detected that could not be explained by associated clinical states. These data are consistent with the prevailing clinical view that significant permanent lung damage does not result from acute exposure to chlorine gas.

1968

35363 APTIC NO. 57842

Videbaek, Jorgen

RESPIRATORY ALLERGY AND CLIMATIC CONDITIONS. I. REVIEW. *Acta Allergol., 23(6):441-454, Dec. 1968. 39 refs.*

The respiratory diseases referred to here include estival fever, vasomotor rhinitis, and bronchial asthma. Climatic factors such as temperature, humidity, pressure, wind, rain, and the electric condition of inhaled air may exert a direct irritating effect on the bronchial, nasal, or tracheal mucosa. Alternatively, climate may indirectly affect the respiratory allergy by giving rise to conditions which promote the growth of pollen-carrying plants or increase the concentration of allergens in the air. Climatic parameters may also act indirectly by changing the toxicity of the allergen, i.e., by changing its water content or electric charge. The literature on this subject is contradictory, but one may conclude that a drop in temperature to below 15 C can cause bronchospasms in some patients. There is no direct correlation between the electric climate in the air and dyspnoea attacks in asthmatics. Finally, the quantitative importance of the direct climatic effect on the patient is small compared with the importance of the climatic effect on allergens.

35364 APTIC NO. 57822

SO2. IS IT A HEALTH HAZARD UNDER NORMAL CONDITIONS? WHAT ARE THE PRACTICAL APPROACHES TO CONTROL? Coal Age, 73(4):72-81, April 1968. 1 ref.

The effects of sulfur dioxide on human health and SO2 control methods are discussed. The recommendation of a 0.1 ppm limit on SO2 concentration contested. After correlating the increased industrial stack gas output and the mortality rates from respiratory diseases, it is concluded that SO2 pollution is not a major health hazard, and that sulfur dioxide at a 2 ppm concentration can be safely discharged into the atmosphere. The tall-stack approach to SO2 dispersion is discussed. Stacks having a height of 2.5 times that of the surrounding buildings insure upper-air dispersion and dilution. Methods discussed for stack- gas cleanup included the use of alkalized alumina or molten salt, catalytic oxidation, catalytic reduction, chemical scrubbing, chromatographic absorption, and dolomite-limestone injection. Car-oil-energy, fluidized combustion, and the H-coal process limit the emission of SO2. The H-coal process involves converting the coal to a hydrocarbon liquid by hydrogenation with a cobalt molybdenum catalyst. Methods for elimination through solvation and conversion include the coal-fired gas turbine, carbon dioxide acceptor gasification, electrogasdynamics, magneto-hydrodynamics, and solvent refining. Estimated 1968 costs and sulfur removal efficiency rates are given for the processes.

1959

35365 APTIC NO. 57915

Breslow, Lester

A CONTINUING STUDY OF CHRONIC RESPIRATORY DISEASE IN A PANEL SELECTED FROM A SAMPLE OF THE GENERAL POPULATION. *Preprint, Calif. Dept. of Public Health, Berkeley, 29p., 1959 (?). 1 ref.*

The effects of air pollution in California on the health of the general population and particularly on those afflicted with chronic bronchitis and closely allied conditions was investigated in a continuing long-range study. A 1956 survey explored the effects of air pollution on the social and psychological aspects of daily living patterns. One adult randomly selected from 3545 households was interviewed in 1956 and 612 of those people were reinterviewed over a period of at least 3 yr at 4-month intervals. The profile of responses to all the condition questions for all rounds, May 1956 to May 1958 is tabulated. The number of people reporting bronchitis in 1956 was 161 as compared to 105 in 1958; for asthma the figures are 90 in 1956 and 71 in 1958; coughing, 543 in 1956 and 487 in 1958; sinus, 203 in 1956 and 183 in 1958; hayfever, 85 in 1956 and 77 in 1958; nose complaints, 125 in 1956 and 104 in 1958; and throat complaints 130 in 1956 and 115 in 1958.

1943

35366 APTIC NO. 57821

Riddervold, Jul and Knut Halvorsen

BACTERIOLOGICAL INVESTIGATIONS ON PNEUMONIA AND PNEUMOCOCCUS CARRIERS IN SAUDA, AN ISOLATED INDUSTRIAL COMMUNITY IN NORWAY. *Acta Pathol. Microbiol. Scand. (Copenhagen), vol. 20:272-298, 1943. 27 refs.*

Investigations on the manganese electrical smelting plant s smoke in Sauda, Norway done in 1930 showed little manganese but large amounts of silica. Later investigations showed a definite relation between the production of manganese alloys and the morbidity and mortality of pneumonia in Sauda. In light of these investigations, a study was made of the bacteriological conditions of Sauda pneumonias. Studies were made of 46 cases of croupous pneumonia, and 2152 samples were obtained from the throats of 1475 healthy persons. The pneumonias show a distribution of the types not differing from that found in previous investigations. In healthy subjects pneumococci were demonstrated in 50% of all samples. The workers and employees of the ferromanganese factories did not seem to be more strongly exposed to infection with pneumococci than the rest of the population of Sauda, and no reliable differences between districts exposed to the smoke from the factory, to a varying extent could be seen. Case histories and tabulated results of the investigation are given.

EFFECTS-PLANTS AND LIVESTOCK

1973

35367 **APTIC NO. 58236**

Kortschak, H. P. and L. G. Nickell

PHOTOSYNTHETIC CARBON MONOXIDE METABOLISM BY SUGARCANE LEAVES. *Plant Sci. Lett., vol. 1:213-216, 1973. 9 refs.*

The photosynthetic carbon monoxide metabolism by sugarcane was studied to determine whether substantial quantities of CO are removed from the air by fields in Hawaii. Leaves metabolized low CO concentrations photosynthetically, with sucrose as an end product. Rates of uptake were of the order of 10 to the -4th power mg/d sq m/hr. This was too low to be significant in removing CO from the atmosphere. (Author abstract modified)

35368 **APTIC NO. 57786**

LeBlanc, Fabius and Dhruva N. Rao

EFFECTS OF SULPHUR DIOXIDE ON LICHEN AND MOSS TRANSPLANTS. *Ecology, 54(3):612-617, Late Spring 1973. 20 refs.*

Injury symptoms in lichen and moss transplants were correlated with sulfur dioxide concentrations in the Sudbury area during 1970. Bark-discs bearing lichens and mosses were cut from an unpolluted region nearly 40 km east of Sudbury. The discs were photographed, and the epiphytes on them were inventoried. These were arranged in groups of six in cut-out holes on wooden boards. Two boards were fixed at 8-10 m on a tall, exposed tree at each of 19 selected sites in the five SO2-polluted zones delineated for the area. After 1 yr, changes in epiphytes, especially in Parmelia sulcata, taking place in the different pollution zones were compared with respect to external and internal morphology, biomass, acidity, total sulfur, and chlorophyll. Different SO2 concentrations produced different sets of harmful effects which were more or less directly related to the pollution levels. While the trend has been to relate floristic and/or phytosociological characteristics of lichens and mosses to SO2 concentrations, the present study sought a quantitative correlation between levels of injuries and levels of SO2. (Author abstract modified)

35369 **APTIC NO. 58286**

Loomis, Robert C.

DISEASE DETECTION SURVEY, AIR POLLUTION, ARIZONA AND NEW MEXICO REGION 3. *Forest Service, Albuquerque, N. Mex., Branch of Forest Insect and Disease Management, R-3 73-24, 128p., June 1973. 24 refs.*

A detection survey was conducted to determine if sulfur dioxide from existing major sources was causing injury to forest vegetation in New Mexico and Arizona. In addition, background information was collected in areas where major sources are expected in the near future. Symptoms of acute SO2 injury were found on Tonto National Forest, near Miami, Ariz.; on the Coronado National Forest, near San Manuel, Ariz.; and on the Apache National Forest, near Morenci, Ariz. Symptoms which resembled SO2 injury, but which needed further evaluation, were noted near Hurley, N. Mex. No areas were found where trees were being killed by SO2 fumigation. (Author abstract)

35370 **APTIC NO. 58129**

McLay, C. L.

WIND-BLOWN DUST AS A SOURCE OF NUTRIENTS FOR AQUATIC PLANTS. *Environ. Pollut., 5(3):173-180, 1973. 7 refs.*

The response of Lemna perpusilla to dust washed from the stems of Scirpus californicus which grows with the duckweed was investigated. Duckweed growth was stimulated by the washings and dust that had accumulated on a concrete wall near the lake. Since dust from both sources produces an immediate growth response by duckweed, the dust must contain soluble nutrients. There is some evidence that salts leached from the Scirpus stems may have been partially responsible for the increase in growth. The utilization of nutrients from this source by aquatic plants represents a previously unsuspected pathway in the nutrient cycle of a lake. (Author abstract modified)

35371 **APTIC NO. 58114**

Robinson, J. W., C. M. Christian, J. D. Martinez, and M. Nathany

SPANISH MOSS AS AN INDICATOR OF LEAD IN THE ATMOSPHERE BEFORE THE USE OF LEADED GASOLINE. *Environ. Letters, 4(2):87-93, 1973. 9 refs.*

Lead levels were determined in old and new samples of Spanish moss, an epiphyte which derives all of its sustinence from the air, in order to examine the extent of environmental Pb contamination resulting from the use of leaded gasoline. Similar levels of lead in both old and new moss indicated that Pb levels today in air remote from highways are similar to the Pb levels in the air before leaded gasoline was used.

35372 **APTIC NO. 58138**

Ruhling, Ake and Germund Tyler

HEAVY METAL DEPOSITION IN SCANDINAVIA. *Water, Air, Soil Pollut., 2(4):445-455, Dec. 1973. 25 refs.*

Maps showing the regional differences in the atmospheric deposition of lead, cadmium, mercury, chromium, nickel, copper, zinc, and iron were prepared for Finland, Norway, and Sweden from data obtained by means of moss analysis, a method previously known to be a sensitive and reliable tool in measuring heavy metal deposition. All the elements in the minima were recorded in northern Norway, the maxima were in southcentral or southwestern Sweden and southernmost Norway. The greatest regional differences were measured in Pb and Cd. Possible sources of error are mentioned. (Author abstract modified)

1969

35373 **APTIC NO. 57859**

Dost, Frank N., D. J. Reed, and C. H. Wang

STUDIES ON ENVIRONMENTAL POLLUTION BY MISSILE PROPELLANTS. *Oregon State Univ., Corvallis Radiation Center, Air Force Systems Command/Aerospace Medical Research Lab. Contract AF33(615)-1767, Proj. 6302, Task 630204, Work Unit 630204001, AMRL-TR-68-85, 28p., Feb. 1969. 3 refs.*

Field evaluation of the effects of inorganic fluoride oxidizing agents accidentally released into the environment are discussed. Information is derived primarily from research previously published. The compounds reviewed are nitrogen trifluoride (NF3), tetrafluorohydrazine (N2F4), oxygen difluoride (OF2), and the interhalogens chlorine trifluoride (ClF3), chlorine pentafluoride (ClF5), and bromine pentafluoride (BrF5). Nitrogen trifluoride has no effect on plants, fish or microorganisms. High concentrations cause reversible toxicity in mammals. Tetrafluorohydrazine has limited effects on plants and its reaction products are fairly harmless to fish. Mammalian toxicity is moderate but reversible. Oxygen difluoride is highly toxic to plants, but does not appreciably harm microbes or fish unless partial pressure remains high. It causes irreversible damage to mammals at very low doses, and as yet no successful decontaminant has been found. The interhalogens are highly toxic to plants. A possibly productive approach to decontamination of the highly toxic OF2 may be through the immediate reaction of the spilled gas by reagents distributed through the cloud, at a time when concentration is high enough to permit relatively easy reaction in a limited area. The decontamination of spilled interhalogens should be easier to accomplish, since they react with almost any material they encounter. Their reactive aqueous solutions must be dealt with as well, but if the waterborne interhalogen reaction products are eluted or percolated through soil, almost all living elements in the environment will be protected. The problem of quickly and safely destroying each of the inorganic fluoride oxidizing agents in air, leaving products which may be dealt with on a non-emergency basis, is being studied.

1968

35374 **APTIC NO. 58015**

Stein, G.

EFFECT OF INDUSTRIAL GASES FROM THE BOHEMIAN BASIN ON THE FOREST REGIONS OF THE UPPER ERZGEBIRGE (ORE MOUNTAINS). *(Der Einfluss von Industrieabgasen aus dem Boehmischen Becken auf die Waldgebiete im oberen Erzgebirge). Text in German. Z. Meteorol., 20(1-6):106-108, 1968. 6 refs. (Presented at the Technische Meteorologie, Meteorologischen GGesellschaft, East Germany, Sept. 22-24, 1966.)*

Extensive damage to fir and pine forests in the crest region of the ore mountains (both in Czechoslovakia and East Germany) was caused by the sulfur dioxide and dust content of air contaminated by industrial waste gases from the Bohemian Basin, in conjunction with severe frost in the winter and spring of 1963. Administrative measures to combat these conditions are described in detail. Numerous biological and chemical analyses are made at a network of air monitoring stations. In addition to determining the SO2 and dust content of air, the sulfur content of fir needles, the fluorine content of fir bark, the trace element content of the humus layer, and its acidity are determined.

EFFECTS-MATERIALS

1973

35375 **APTIC NO. 58179**

Duncan, J. R. and D. J. Spedding

THE EFFECT OF RELATIVE HUMIDITY ON ADSORPTION OF SULPHUR DIOXIDE ON TO METAL SURFACES. *Corrosion Sci., 13(12):993-1001, Dec. 1973. 11 refs.*

A continuous flow exposure method has been employed to supplement previous studies of the influence of relative humidity and corrosion products on the uptake of sulfur dioxide onto metals in order to examine uptake rates onto iron and zinc. The results agreed closely with those from a previously reported interrupted-flow method for most areas studied. Sample preparation before exposure was found to have a considerable effect upon the results achieved, especially for Fe at humidities equal to or greater than 90%. There was a measurable desorption of SO2 from a Zn surface after removal from an SO2-containing atmosphere, and the pseudo-first order half-life of the reaction was approximately 7.2 ksec. Desorption from some Fe samples was also observed but was irregular and could not be quantified. (Author abstract modified)

35376 **APTIC NO. 58181**

Homma, Katsunori, Hiroyuki Sakabe, and Yoshio Otsuka

STUDY ON PARTICULATE AIR POLLUTANTS BY THE THIN METAL FILM METHOD. *(Kinzoku usumakuho ni yoru taiki osen ryushijo busshitsu no kenkyu). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 8(3):449, Oct. 1973. (Presented at the Japan. Society of Air Pollution, Annual Meeting, 14th, Fukushima, Japan, Nov. 6-8, 1973, Paper 183.)*

The behavior of particle pollutants and their corrosiveness were tested by thin iron films. On the days when photochemical smog was expected, from early morning to evening, particulates were captured on iron films at three locations in Kawasaki, and the degree of corrosion was measured by an optical microscope. Electrodynamic impactors were used for capturing particulates at the speed of 20 l/min, for 30 sec, every 30 min, or one hour. The amount of corrosion is related to the concentration of suspended particulates; but the degree of corrosion suggested the multiple effects of coexisting sulfur oxides and relative humidity, oxidants, and nitrogen oxides.

35377 **APTIC NO. 58184**

Jellinek, H. H. G. and T. J. Y. Wang

REACTION OF NITROGEN DIOXIDE WITH LINEAR POLYURETHANE. *J. Polymer Sci., 11(12):3227-3242, 1973. 15 refs.*

Linear polyurethane was exposed to nitrogen dioxide over a temperature range from 15-60 C at pressures of 20 and 2 mm mercury, respectively. Normal random-chain scission of urethane links occurred and was accompanied by a limited amount of random cross-linking; the crosslinks were eventually irreversibly scissioned again. Carbon dioxide was concurrently evolved; and the infrared spectra of the polymer films changed during exposure, indicating disappearance of urethane linkages and the formation and decay of nitro and nitroso groups along the polymer backbone. The overall reaction was diffusion-controlled at least down to a film thickness of 10 micron, and all energies of activation of the various processes were relatively small as expected for a diffusion controlled process. Tentative mechanisms were proposed which agreed well with experimental results. (Author abstract modified)

1968

35378 **APTIC NO. 58197**

Bohnenkamp, K.

GAS VOLUMETRIC MEASUREMENTS OF ATMOSPHERIC CORROSION. *(Gasvolumetrische Messung der atmosphaerischen Korrosion). Text in German. Werkstoffe Korrosion, 19(9):792-795, Sept. 1968. 6 refs.*

The oxygen consumption in the corrosion of steel samples were measured. Construction steel with 0.02% copper was primarily used, but some samples of pure iron and slowly corroding steel with 0.37% Cu, 0.21% phosphorus, 0.4% chromium, and 0.48% nickel were also taken. The first surprising result was that in pure oxygen at 100% relative humidity, no measurable oxygen consumption occurred and no visible corrosion could be observed within 40 days. Further tests with samples were the corrosion process had been initiated by immersing them in distilled water for several days also showed a weak corrosion which soon halted. Measurable and more intense corrosion occurred after small amounts of sulfur dioxide were added. In intervals of 3 to 10 days, 0.63 mg, 0.21 mg, or 0.063 mg of SO2 were added. Mean corrosions over six weeks were 4 to 5, 2, and below 0.5 g/sq m/day, respectively, for the various SO2 concentrations. A clear increase of the velocity of oxygen consumption was generally observed several hours after the first addition of SO2. In the first days, the corrosion process dropped markedly and remained constant for the rest of the period. The overall corrosion increased less than proportionally to various added amounts of SO2. In experiments where the samples were first exposed to SO2 with the oxygen added later, the initial corrosion activity was much more pronounced. After one day, it had reached the extent of the earlier experiments. For comparison with actual atmospheric corrosion, two samples were first exposed for 16 days to open air, and the corrosion process was subsequently observed for 6 weeks under laboratory conditions. Both samples corroded as much in the 16 days outside as they did in over 40 days in the laboratory. The outside temperature was lower, and the samples were not always visibly wet.

1936

35379 **APTIC NO. 58835**

Takats, T. von

ON THE REACTIONS OF SILICATES WITH SULFUR DIOXIDE. *(Ueber die Reaktionen von Silikaten mit Schwefeldioxyd). Text in German. Glastech. Ber., 14(3):103-105, March 1936. 7 refs.*

The reactions of various types of glasses with sulfur dioxide below the softening point of the glass have significant technological consequences. Such reactions were therefore studied by means of pulverized glass samples subjected to temperatures of 300, 350, 400, 450, 500, and 550 C in a muffle furnace through which air with 5% SO2 was flushed. The resulting sulfur dioxide concentration in the glass was analytically determined. The results, given in tables, are expressed as percent of the metal oxides which were converted to sulfates. The highest value found was 39.2% of potassium silicate at 550 C. The glass types investigated were: sodium silicate glass of various acidity, lithum silicate glass, and four different lead silicate glasses.

EFFECTS-ECONOMIC

1973

35380 **APTIC NO. 57954**

Aldrich, Robert H. and Neil A. Eisner

HOW TO SAVE 30% OF THE COST OF POLLUTION CONTROL FACILITIES. *Paper Process., 9(11):43-45, Nov. 1973.*

By taking full advantage of the environmental financing alternatives available, a corporation can reduce the total cost of compliance to air pollution regulations by over 30%. They can significantly minimize the negative cash-flow normally associated with pollution control costs. They can also, under certain corporate circumstances, actually achieve a positive net present value for a pollution control facility that is nonproductive. Financial factors include the cost of money, cash flow, tax incentives, balance sheets, internal earnings objectives, availability of funds and money market projections, future demand for capital funds, and existing and projected debt limitations. Financing alternatives commonly used include internally generated funds, bank financing, long-term debt financing, lease financing, tax-exempt pollution control financing, and sharing public facilities on a user-fee basis. The most interesting financing alternative is tax-exempt pollution control bond use. In the last 12 months, over $1 billion of this type of financing has been utilized by industry. Tax-exempt bond legislation, inerest rates, and Internal Revenue Service regulations are reviewed.

35381 **APTIC NO. 57921**

Bergman, P. D., K. D. Plants, J. J. Demeter, and D. Bienstock

AN ECONOMIC EVALUATION OF MHD-STEAM POWER PLANTS EMPLOYING COAL GASIFICATION. *Bureau of Mines, Pittsburgh, Pa., Pittsburgh Energy Research Center, and Morgantown, Va., Morgantown Energy Research Center, RI 7796, 33p., 1973. 26 refs.*

To assess the efficacy and economics of producing power from coal, four open-cycle magnetohydrodynamic (MHD) processing schemes were selected for study. Each involved a different mode of coal combustion and level of gas cleanliness. The options considered were: coal burned in a slagging combustor; suspension gasification with slag removal prior to combustion; parallel cyclone combustors, one operating fuel-rich and the other operating with excess air; and suspension gasification by the hot exhaust gases from the MHD dust with ash removed prior to combustion. The first option has the highest ash content in the combustion plasma and as a result would have the greatest operational difficulties associated with it. The second and fourth options have the cleanest MHD combustion plasma. For coal priced at $4/ton, the power generating cost of the fourth option, 11.78 mills/kW-hr is the highest, with the first option, at 9.04 mills/kW-hr the lowest. These costs may be compared with a conventional power cost of 9.92 mills/kW-hr for the late seventies. Capital costs of three of the four options were competitive with those of conventional thermal power plants employing stack gas sulfur dioxide cleanup systems. The second option has the most favorable combination of operating characteristics and power cost. A clean, high-temperature working fluid can probably be produced from coal without leading to depressed system efficiencies and exorbitant capital costs. (Author abstract)

35382 **APTIC NO. 55950**

Busterud, John A.

THE IMPACT OF ENVIRONMENTAL CONTROL ON INTERNATIONAL TRADE AND ECONOMICS. *Preprint, 5p., 1973. (Presented at the International Pollution Engineering Congress, Philadelphia, Pa., Oct. 22-25, 1973.)*

The impact of environmental control on international trade and economics is described. There has been some fear that strict pollution control regulations will raise costs enough to impair the international trade position of the United States. Government sponsored studies indicate that the expenditures for pollution control programs will not be a major factor in foreign competition. The government is working with other countries for the harmonization of environmental standards and adoption of the polluter pays principle. Benefits flowing from a cleaner environment and the multibillion dollar sales of pollution control equipement by U. S. companies may well outweigh the minor adverse effects on the trade balance. (Author abstract modified)

1972

35383 **APTIC NO. 57789**

Byrne, Joseph and Milton J. Gorham

ENVIRONMENTAL CONCERNS - THEIR EFFECT ON GASOLINE MARKETING. *Preprint, American Inst. of Chemical Engineers, New York, 28p., 1972. 5 refs. (Presented at the American Institute of Chemical Engineers National Meeting, 71st, Dallas, Tex., Feb. 23-24, 1972. 5 refs. (Also: Am. Inst. Chem. Engrs. J., 69(127):167-168, 1973.)*

The effects of environmental demands on gasoline marketing are examined. It is becoming increasingly difficult to supply the customer both the volume of gasoline he wants and the quality he needs. Extreme requirements for emission control and the drive to eliminate lead from gasolines are expected to produce drastic losses in octane quality; and, unless a careful balance between car requirements and refining capability is maintained, the customer will suffer from poor performance, shortages of proper fuel, or excessive costs. Additionally, volatility limitations which have been proposed to help the auto manufacturer meet the severe 1975 government standards would result in elimination of gasoline fractions that include most of the high-octane components available. Lower efficiencies caused by reduced compression ratios and emission controls will result in a significantly larger volume of gasoline which must be supplied.

35384 **APTIC NO. 57806**

Paddock, Richard E., Franklin A. Ayer, Alex B. Cole, and David A. LeSourd

COMPREHENSIVE STUDY OF SPECIFIED AIR POLLUTION SOURCES TO ASSESS THE ECONOMIC IMPACT OF AIR QUALITY STANDARDS: ASBESTOS, BERYLLIUM, MERCURY. VOLUME I. (FINAL REPORT). *Research Triangle Inst., Research Triangle Park, N. C., Environmental Studies Center, Environmental Protection Agency Contract 68-02- 0088, RTI Proj. FR-41U-649, APTD-1548, 126p., Aug. 1972. 61 refs.*

NTIS: PB 222857

Estimates are made of the costs of controls necessary to reduce the emissions of asbestos fibers, beryllium, and mercury from primary production and selected secondary sources within the United States. Production processes and control technology are examined. Controls are selected to meet assumed or proposed emission standards and costs are estimated. In addition, an extended analysis is made where appropriate to determine the economic impact of control costs on each industrial source or group of sources studied. The effects on prices are also estimated. Under the assumed implementation plan, the estimated costs are those that will be incurred between Fiscal years 1970 through 1977. (Author abstract)

35385 **APTIC NO. 57885**

LeSourd, D. A. and F. L. Bunyard (eds.)

COMPREHENSIVE STUDY OF SPECIFIED AIR POLLUTION SOURCES TO ASSESS THE ECONOMIC IMPACT OF AIR QUALITY STANDARDS. VOLUME I. (FINAL REPORT). *Research Triangle Inst., Research Triangle Park, N. C., Environmental Studies Center, Environmental Protection Agency Contract 68-02-0088, RTI Proj. FR-41U-649, APTD-1547, 376p., Aug. 1972. 108 refs.*

NTIS: PB 222857

Air pollution control costs for mobile sources within the United States are presented on a national basis in terms of unit investment and annual and total annual operating and maintenance costs. The analyses cover the estimated emissions and control costs for model year 1968 through 1977 light-duty and heavy-duty road vehicles. The pollutants analyzed are hydrocarbons, carbon monoxide, and nitrogen oxides. Three general classes of stationary sources are also considered: solid waste disposal (open burning and incineration), stationary fuel combustion (heating and power generation), and industrial processes. The industrial sources studied include: asphalt batching; cement manufacturing; grain plants; gray iron foundries; iron and steel production; kraft (sulfate) pulping; lime production; nitric acid production; petroleum products manufacture and storage; petroleum refineries; phosphate industry; primary aluminum, copper, lead, and zinc manufacture; secondary nonferrous metallurgy; and sulfuric acid production. Stationary source control costs are projected for Fiscal years 1973-1977, with estimates being made for particulates, SOx, HC, CO, and NOx. Extended analyses are made to determine the impact of control costs on each industrial source, buyer industries, consumer prices, and families of different income levels. Fiscal year 1967 was selected as the baseline year, and all dollar amounts are expressed in 1970 prices and constant 1970 dollars. (Author abstract modified)

1969

35386 **APTIC NO. 50371**

Hamerlak, S.

COST OF DUST EXTRACTION INSTALLATIONS. *(Koszty instalacji odpylajecych). Air Conserv. (English translation from Polish of: Ochrona Powietrza), 3(5):1-6, 1969. (Presented at the Association of Metallurgical Engineers and Technicians, Conference on Modern Trends in Cleaning of Industrial Gases by Wet Methods, Bielsko, Poland, March 1969.)*

NTIS: TT 70-55123/5

Basic criteria of the economic application of dust extraction installations and their selection are discussed. Unit indices of capital outlay for various types of dust collection devices are also discussed. Dust extraction installations may be classified as follows: class I, particles up to 1 micron; class II, 1-10 micron; class III, 10-50 micron; and class IV, over 50 micron. Selection of type of installation should be guided by granulometric analysis of dust and the prescribed dust extraction effectiveness. The technical-economic indices are listed for multicyclones, wet collectors, natural cloth filters, two and three pole electrofilters, venturi scrubbers, and teryline cloth filters.

1968

35387 **APTIC NO. 57907**

Cosby, W. T. and G. Punch

COST AND PERFORMANCE OF FILTRATION AND SEPARATION EQUIPMENT. DUST FILTERS AND COLLECTORS. *Filtration Separation (Purley), 5(3):252-255, May/June 1968. 1 ref.*

Factors influencing the selection and operating efficiency of fabric filters, venturi scrubbers, and electrostatic precipitators were considered, and cost comparison data established for the units. Hypothetical duties required 98-99% efficiencies. Annual costs were calculated for filters rated at 3.5 and 1.75 fpm, precipitators sized for drift velocities at 12 and 5 cm/sec, and scrubbers with throat pressure drops of 14 and 15 in. in Wg. Analysis shows that annual costs of ancillary equipment, characteristics of the carrier gas, and annual operating costs affect the cost relationship among the alternative units. Venturi scrubbers are not competitive when only total running cost vs capacity for gas temperatures of 60 F is considered. But their inlet volume is not adversely affected by high-cooling temperatures. The scrubber and fabric filter perform equally well for 2000 hr/yr operations. The precipitator is competitive only on an 8000 hr/yr basis.

STANDARDS AND CRITERIA

1974

35388 **APTIC NO. 5814**

Quarles, John

TECHNICAL AMENDMENTS ON 1975 AND LATER MODEL YEAR LIGHT DUTY GASOLINE VEHICLE, LIGHT DUTY TRUCK, AND HEAVY DUTY GASOLINE ENGINE CERTIFICATION TESTING FUEL. *Federal Register, 39(14):2363-2365, Jan. 21, 1974.*

The motor vehicle regulations specify the type of fuel which may be used for emission testing and for mileage and service accumulation. Since the present regulations give a phosphorus specification for unleaded fuel which is based on the amount of lead in fuel, would require EPA to have potentially almost limitless varieties of test fuel in its own test facility, do not specify what is meant by octane range, and do not specify the lead content of the leaded fuel, the following technical amendments to the regulations were made: the phosphorus specification for unleaded and leaded fuel was revised; a standardized fuel can be used for emission testing; the meaning of the octane range was clarified; and the lead content of the leaded fuel used in certification testing was specified. Gasoline specifications are given for the fuels used in testing.

35389 **APTIC NO. 58137**

Train, Russell E.

SECONDARY STANDARDS FOR PARTICULATE MATTER IN IDAHO. APPROVAL AND PROMULGATION OF IMPLEMENTATION PLANS. *Federal Register, 39(3):1063, Jan. 4, 1974.*

The secondary standard for particulate matter in Idaho which is part of that state s implementation plan has been set, based on studies of emission sources and particulate levels at rural, urban residential, and business areas of several cities. Persons interested in participating may send written comments to the Environmental Protection Agency.

35390 **APTIC NO. 58147**

Train, Russell E.

LIGHT DUTY DIESEL TRUCKS. CONTROL OF AIR POLLUTION FROM NEW MOTOR VEHICLES AND NEW MOTOR VEHICLE ENGINES. *Federal Register, 39(18):3276-3290, Jan. 25, 1974.*

Proposed standards for light duty diesel trucks are described. The first date of applicability has been set for the 1976 model year. The general applicability, definitions, abbreviations, general standards, and hearings for the regulations are discussed. The various procedures for certification are described including maintenance of records, applications, test equipment and vehicles, and required data. The dynamometer procedure is described. The sampling and analytical system and its calibration are described. Exhaust emission standards for the 1976 and 1977 model years are 2 g/mi hydrocarbons, 20 g/mi carbon monoxide, and 3.1 g/mi oxides of nitrogen. No crankcase emissions are to be discharged.

1973

35391 **APTIC NO. 55735**

Hartmann, H. F.

AIR QUALITY STANDARDS. *Clean Air (J. Clean Air Soc. Australia New Zealand), 7(2):36-40, May 1973.*

Global background values, United States primary and secondary air quality standards, World Health Organization air quality goals, and United States air quality criteria are examined for nitrogen dioxide, sulfur dioxide, particulate matter, carbon monoxide, and photochemical oxidants, including ozone with the contention that United States primary air quality standards should be adopted in Australia, subject to periodic review as further evidence becomes available. The American standards are based on health considerations which have been accepted by the World Health Organization. Secondary air quality standards are not recommended for Australia until more is known from monitoring data regarding the levels which cause damage to vegetation, reduce visibility, and produce other deleterious effects. Automobile emission standards to be recommended for Australia will probably be achievable without the necessity of resorting to hang-on devices such as thermal and catalytic afterburners.

1972

35392 **APTIC NO. 58182**

Rook, Harry L., Philip D. LaFleur, and Thomas E. Gills

MERCURY IN COAL: A NEW STANDARD REFERENCE MATERIAL. *Environ. Letters, 2(4):195-204, 1972. 11 refs.*

The results of a concerted analytical program by the National Bureau of Standards to develop a coal standard of proven homogeneity with an accurate value of mercury concentration are presented. The standard used for determining the Hg level in a series of coal samples issued by the Bureau of Mines was SRM 1630 a commercial-lot West Virginia coal, with a mean Hg content of 0.127 ppm (standard deviation 0.0061 ppm). The results of subsequent sample analyses indicated a low Hg content of 0.05 ppm for a Colorado coal and a high content of 0.5 ppm for an Ohio coal, with the average in the order of 0.1-0.2 ppm. Composite results indicated the need for better standardization of Hg analyses. Use of SRM 1630 to standardize individual methods should substantially improve the accuracy of interlaboratory Hg analyses.

35393 **APTIC NO. 58266**

Dept. of Health, Education, and Welfare, National Inst. For Occupational Safety and Health.

CRITERIA FOR A RECOMMENDED STANDARD....OCCUPATION EXPOSURE TO CARBON MONOXIDE. *122p., 1972. 129 refs.*

GPO

The recommendation of the National Institute for Occupational Safety and Health for occupational exposure limitations for carbon monoxide is presented. In a work environment, no worker can be exposed at a concentration greater than 35 ppm determined as a time weighted average exposure for an 8-hour workday as measured with a portable, direct reading, hopcalite-type carbon monoxide meter calibrated against known concentrations of CO, or with gas detector tube units certified under Title 42 of the Code of Federal Regulations, Part 84. No level of CO to which workers are exposed can exceed a ceiling concentration of 200 ppm. Mandatory procedures for calibration of equipment, sampling, and analysis of CO samples are included.

1969

35394 **APTIC NO. 58033**

NORMS FOR THE COMBATING OF DUST IN ATMOSPHERIC AIR. *(Normalizacja w zwalczaniu zapylenia powietrza atmosferycznego). Text in Polish. Przemysl Chem., 48(2):102-103, 1969.*

The magnitude of the air pollution problem resulting from the discharge of dusts or dust-laden gases may be appreciated from the fact that 2.8 million tons of pollutants were discharged in 1965 in Poland by industries that burn solid fuels. The pollutants not only are harmful to humans and to animal and plant life, but also represent a considerable economic loss, amounting to from 1 to 10% of the materials employed. Poland has therefore issued nine standards, dealing with the characteristics of dusts, dust-laden gases, and dust extraction methods and equipment. These are listed by number. They are based on experience in Poland and other highly industrialized countries.

LEGAL AND ADMINISTRATIVE

1974

35395 **APTIC NO. 58136**

Train, Russell E.

NORTH CAROLINA IMPLEMENTATION PLAN. APPROVAL AND PROMULGATION OF IMPLEMENTATION PLANS. *Federal Register, 39(3):1063, Jan. 4, 1974.*

Additional implementation plan requirements have been promulgated relative to the maintenance of the national standards of ambient air quality in North Carolina due to several court cases. These requirements were used to revise the implementation plan pertaining to the review of new or modified indirect pollution sources. Permits would be required for construction or modification of parking areas, residential developments, recreation areas, highways, and airports. Copies of the plan revision are available from the Environmental Protection Agency, and written comments can be submitted to EPA.

35396 **APTIC NO. 58143**

Train, Russell E.

APPROVAL AND PROMULGATION OF IMPLEMENTATION PLANS. PROPOSED REVISIONS TO IDAHO AND WEST VIRGINIA IMPLEMENTATION PLANS. *Federal Register, 39 (12):2107-2108, Jan. 17, 1974.*

Pursuant to the Clean Air Act, State Plans for implementation of national ambient air quality standards have been approved. The proposed revision for the Idaho implementation plan regarding its legal enforcement and the proposed revision to the control strategy of the West Virginia implementation plan regarding the sulfur oxide emission standard are described. Written comments to these revisions are now being accepted.

35397 **APTIC NO. 58146**

Train, Russell E.

LOW EMISSION VEHICLE CERTIFICATION BOARD. NOTICE OF DETERMINATION REGARDING SUITABILITY OF PURCHASE BY FEDERAL GOVERNMENT. *Federal Register, 39(12):2137, Jan. 17, 1974.*

Four types of battery-powered vehicles were denied certification as substitutes for vehicles purchased by the Federal Government. Although they were low-emission vehicles, they gave a maximum speed of only 25 mph, sustained a maximum velocity on a 5% grade of only 17 mph, and had low acceleration.

1973

35398 **APTIC NO. 57081**

Chamblee, Carolyn P. and Gerald J. Nehls

SAROAD TERMINA USER S MANUAL (FINAL REPORT). *Office of Air and Water Programs, Research Triangle Park, N. C., Monitoring and Data Analysis Div., EPA-450/2-73-004, 90p., Oct. 1973.*

NTIS: PB 226318/AS

A SAROAD (Storage and Retrieval of Aerometric Data) Terminal User s Manual has been developed to define procedures for receiving data and summaries from the National Aerometric Data Bank via a computerized system. One section describes how to interactively request air pollution information using a remote terminal, while another furnishes procedures for requesting batch jobs to be run later with the output sent either to a medium speed printer or to the central computer site where it is mailed to the user. A third section describes other output formats which are available by mailed requests. Information available through the system includes yearly and quarterly frequency distributions, raw data listings, data and site inventories, special reports on the criteria pollutants, and various summary statistics.

35399 **APTIC NO. 57932**

Feller, Irwin, Alfred J. Engel, Robert S. Friedman, Donald C. Menzel, and John F. Sacco

INTERGOVERNMENTAL RELATIONS IN THE ADMINISTRATION AND PERFORMANCE OF RESEARCH ON AIR POLLUTION. SUMMARY REPORT. *Pennsylvania State University, University Park, Pa., Center for the Study of Science Policy, National Science Foundation Grant 3, 27p., March 1973. 25 refs.*

NTIS: PB-222429

State and municipal air pollution control agencies currently perform little research and development, and it is unlikely that they will expand their activities in the near future. The small amount of research and development performed by state and local control agencies is due to: limited funds for this function; the view that enforcement is their primary responsibility; the lack within many agencies of personnel trained to undertake research and development; and a pervasive negative attitude throughout state government toward research and development expenditures. Federal research and development is often inaccessible to state and local officials. A clear deficiency in the present information access system is in the transmission of findings from federally sponsored research to state and local agencies and the interpretation and application of these findings at the state and local levels. The existing channels consist primarily of listing with the Commerce Department s National Technical Information Service and publication in technical bulletins and these are inadequate. State and municipal agencies do receive technical information from the Environmental Protection Agency when they make specific requests. In addition, New York employs professional staff in a systematic screening of the technical literature. In other states and municipalities, the technical staffs attempt to keep abreast of the technical literature as best they can. The lack of any formalized system of information dissemination or of any follow-up on the utility of sponsored research reduces the value of existing work and makes it more difficult to install internal checks on the effectiveness of particular types of research or of researchers. Finally, research and development at state and local levels fulfills other functions besides probelm solving. It may be a necessary part of maintaining a generally high level of technical competence within a state or municipal agency.

35400 **APTIC NO. 58168**

Kirk, Alan G., II

WEST VIRGINIA AIR QUALITY PLAN NOTICE OF POSTPONEMENT OF PUBLIC HEARING. *Federal Register, 38(228):32836-32837, Nov. 28, 1973.*

A public hearing scheduled for December 10, 1973 at Charleston, West Virginia to consider whether seven electric utility generating stations located within the State should be granted one-year postponements from the compliance dates specified in two sections of the West Virginia Implementation Plan to Achieve and Maintain Air Quality Standards has been postponed until January 14, 1974. It was noted at a prehearing conference that the State had recently adopted a higher sulfur dioxide emission ceiling for sources located in the regions where the ambient air quality standards were being met; and it was further noted that, if approved by the Environmental Protection Agency, this Plan revision would have a significant impact on the four electric utility stations which were seeking relief from the compliance dates specified in Regulation X of the West Virginia Plan. It was agreed that discussion relating to SO2 emission requirements ought to reflect both the existing requirements of the Plan and the requirements which would come into effect if the Plan revision were approved by the Agency; thus, additional time was granted to consider this new aspect of the case.

35401 APTIC NO. 58155

Meyers, Sheldon

ENVIRONMENTAL IMPACT STATEMENTS. AVAILABILITY OF AGENCY COMMENTS. *Federal Register, 38(240):34489-34490, Dec. 14, 1973.*

The reviews and comments of the Environmental Protection Agency on Federal Agency actions affecting the environment are summarized. Appendix I contains a listing of draft environmental impact statements. Appendix II contains the definitions of the classifications of the comments. Appendix III contains a listing of final environmental impact statements. Appendix IV contains a listing of proposed Federal agency regulations, legislation proposed by Federal agencies, and any other proposed actions. Appendix V contains a listing of the names and addresses of the sources for copies of the comments.

35402 APTIC NO. 59647

Niwa, Kiyoshi, Kumie Nishiyama, and Tsuyoshi Sakanishi

ENVIRONMENTAL DATA BASE. *(Kankyo deta besu shisutemu (1). Text in Japanese. Preprint, Japan Society of Air Pollution, p. 297, 1973. (Presented at the Japan Society of Air Pollution, Annual Meeting, 14th, Fukushima, Japan, Nov. 6-8, 1973, Paper 48.)*

The functions and data that should be included in an environmental data base system are a variety and quantity of data; facilities for easy accumulation, processing, and search; and an easy method of preparation of various analytical and statistical data. The material which should be accessible in such data base system are: local statistics, economic and industrial activities, population, land use, and topography of a given area; emission source information, such as the quantities and types of fixed and mobile emission sources; and pollution information, on air quality, flue gas measurements, physical, chemical, and biological consistencies, and meteorological data; and damage information, consisting of types and amounts of complaints, health statistics and examination details, and records of plant and animal damages. The data base structure and functions are presented in a flow chart.

35403 APTIC NO. 58164

Quarles, John

SUSPENSION REQUESTS AND DISPOSITIONS ON EMISSION CONTROLS. *Federal Register, 38(229):32965-32966, Nov. 29, 1973.*

The Administrator of the Environmental Protection Agency on July 16, 1973 granted a one-year suspension of the 1975 light-duty vehicle exhaust emission standards to the Checker Motors Corporation and 26 other manufacturers who had filed applications. Requests for suspension of the same standards by Glassic Industries, Inc., and Automobili F Lamborghini have been granted pursuant to an August 21, 1973 notice of intention to do so. Suspension of the standards for Toyo Kogyo will occur within 30 days from the date of publication of this notice. Any request for hearing should state the reasons why the announced intention of the Administrator should be considered further at a public hearing.

35404 APTIC NO. 58166

Quarles, John

APPROVAL AND PROMULGATION OF IMPLEMENTATION PLANS. SULFUR DIOXIDE EMISSIONS IN ARIZONA AND NEW MEXICO. *Federal Register, 38(242): 34743-34746, Dec. 18, 1973.*

Newly developed data bearing on March 23, 1973 regulations set forth by the Administrator of the Environmental Protection Agency concerning the limitation of sulfur dioxide emissions from the Navajo power plant located in the Arizona portion of the Four Corners Interstate Region and the Four Corners and San Juan power plants located in the New Mexico portion of the Region were presented at a meeting on August 20, 1973 and dealt with the following main topics: the validity of the assumptions employed in the diffusion model used to calculate the degree of control of SO2 emissions necessary to attain and maintain the national standards; the final date by which each of the affected power plants must be in total compliance with the promulgated regulation; and the format of the equation with the promulgated regulation used to calculate the allowable sulfur oxides emissions. The administrator has proposed to extend the final compliance date for attainment of the national standards for SOx in the Arizona and New Mexico portions of the Region from March 15, 1976 to July 31, 1977 based on information presented by the power companies. An emission limitation has also been proposed which will provide for compliance on a total plant basis rather than on a unit-by-unit basis.

35405 APTIC NO. 57947

Sanderson, John G.

INVOLVE MILL COMMUNITY IN AMBIENT AIR SURVEY. *Pulp Paper Mag. Can. (Quebec), 74(11):39-40, Nov. 1973. (Presented at the Canadian Pulp and Paper Association, Air and Stream Improvement Conference, 8th, Andrews-by-the-Sea, N. B., Candada, Nov. 11-13, 1973.)*

The community should be involved in any ambient air survey. First, measurement methods must be decided on. Then the community should become involved by the distribution of information and contact with citizens groups. Wind and speed direction should be measured. Measurement stations should be kept away from roads and other sources of pollution. High-volume samplers, dust buckets, and sulfation candles should be used for measurement methods. Coupons of steel, zince, copper, and aluminum can be exposed to determine corrosion rates. Sulfate, corrosion, dust fall, and suspended particulate results for one such program are described.

35406 APTIC NO. 58100

Train, Russell E.

NATIONAL CAPITAL REGION TRANSPORTATION CONTROL PLANS. *Federal Register, 38(234):33701-33731, Dec. 6, 1973.*

The implementation plans of the District of Columbia, Maryland, and Virginia have been amended to provide a single unified transportation control plan for the National Capital Interstate Air quality Control Region. Air pollution in this region and the control plan are described. The plan includes restraints on heavy duty vehicles, mass transit incentive surcharges, parking restrictions, increased mass transit, development of a commuter rail and underground system, retrofit of automobile control equipment, dry cleaning vapor controls, bicycle routes, land use measures, inspection/maintenance programs for vehicles, improved recovery during gasoline loading and sales, modifications of solvent use in dry cleaning, aircraft ground operations control, expansion of bus lanes, expansion of the bus transit system, elimination of free commuter parking and development of mass transit incentives, on-street parking restrictions, computerized car pooling, review of parking areas, heavy duty vehicle restrictions and retrofit, air/fuel retrofit of heavy duty gasoline vehicles (greater than 10,000 pounds), catalytic retrofit of fleet vehicles, and retrofit of pre-1968 automobiles. The economic and social effects of these changes are described. Monitoring and reporting regulations are discussed. The plan for the District of Columbia is also described. Approval status, compliance schedules, source surveillance, transportation and land use controls, carbon monoxide and photochemical oxidant (hydrocarbons) control strategies, rules, regulations. Federal parking facilities, gasoline transfer vapor control, control of evaporative losses from filling of vehicular tanks, control of dry cleaning solvent evaporation, inspection/maintenance program, bicycle lanes and storage facilities, medium duty air/fuel control retrofit, heavy duty air/fuel control retrofit, oxidizing catalyst retrofit, and vacuum spark advance disconnect retrofit are described as part of the Washington, D. C., Maryland, and Virginia plans.

35407 **APTIC NO. 58139**

Train, Russell E.

CONTROL OF AIR POLLUTION FROM AIRCRAFT AND AIRCRAFT ENGINES. CORRECTIONS. *Federal Register, 38(242):34734-34735, Dec. 18, 1973.*

Corrections are listed for several minor errors that were made in the regulations promulgated on July 17, 1973 for control of pollution from aircraft and aircraft engines (38 FR 19088). Part 87, Title 40, Code of Federal Regulations is thus corrected for the following: 87.64, 87.66, 87.70, 87.99, and paragraph (a) to Appendix A.

35408 **APTIC NO. 55802**

Yoshida, Keiichi

COUNTERMEASURE AGAINST POLLUTION AND COMMUNICATION TECHNOLOGY. *(Kogai boshi taisaku to tsushin gijutsu). Text in Japanese. Tsushin Kogyo (Commun. Ind.), 13(5):30-35, May 1973.*

A data processing system for air pollution monitoring is described. Automatic observation stations for ambient air sampling measure sulfur oxides, dust, carbon monoxide, nitrogen oxides, oxidants, temperature, humidity, and wind variables and send this data to the central monitoring room via radio telemeter. Mobile units collect data on pollution levels and smog due to automobile emissions and also send it to the central office. A terminal sub-system is comprised of an inversion layer observation station which monitors temperature inversions in the upper atmosphere and a fire flue monitoring device which measures SOx in smoke, both of which submit their data to the central processing room. This composite data is then sent to the pollution investigation center for further processing.

35409 **APTIC NO. 57798**

National Environmental Research Center, Research Triangle Park, N. C., Quality Control Branch

DEVELOPMENT OF A QUALITY ASSURANCE PROGRAM FOR NERC/RTP AIR AND SOURCE MONITORING ACTIVITIES. *Preprint, 50p., Sept. 26, 1973.*

In Feb. 1973, the Environmental Protection Agency developed an agency-wide quality control policy. The Quality Assurance and Environmental Monitoring Laboratory (QAEML) within the National Environmental Research Center (NERC) at Research Triangle Park, N. C. was designated as the organization responsible for implementing an EPA wide quality control program for air activities. An achievement plan is proposed for a quality assurance program for NERC air and source monitoring activities. Its objective is to develop and operate a program which will assure the collection and retention of valid results and guarantee the comparability of data generated between laboratories performing similar air or source monitoring activities. The activities covered under the first achievement plan are those for criteria pollutants (sulfur dioxide, nitrogen dioxide, carbon monoxide, hydrocarbons, oxidants, and total suspended particulates) and the subsequent characterization of total suspended particulates with respect to particle size and the determination of chemical composition, i.e., sulfates, nitrates, trace elements, benzene soluble organics, and benzo(a)pyrene. Other achievement plans will be prepared as needed. The monitoring programs conducting activities in these areas are the Community Health Environmental Surveillance Studies (CHESS) and the Community Health Air Monitoring Program (CHAMP) of the Human Studies Laboratory, the Regional Air Monitoring System (RAMS) under the direction of the Meteorological Laboratory, source monitoring activities on Demonstration Projects of the Control Systems Laboratory, and air and source monitoring studies by QAEML. It is recommended that a quality assurance program for NERC air and source monitoring activities as described in this document be implemented immediately. Basic elements of this program including milestones and resource requirements are summarized. (Author summary modified)

35410 **APTIC NO. 57935**

General Accounting Office, Washington, D. C.

ASSESSEMENT OF FEDERAL AND STATE ENFORCEMENT TO CONTROL AIR POLLUTION FROM STATIONARY SOURCES-ENVIRONMENTAL PROTECTION AGENCY. *Rept. B-166506, 43p., Aug. 23, 1973.*

Since the enactment of the Clean Air Amendments of 1970, which extended and somewhat modified the regional concept of the Air Quality Act of 1967, both the Federal and State governments have improved their air pollution control programs. As required by the act, air quality regions have been established for the Nation, and the States have submitted implementation plans to the Environmental Protection Agency (EPA). The States have taken, or plan to take, action to correct many of the factors which had contributed to limited enforcement. Although adopting plans is an important step forward in controlling air pollution, the States still need to fully implement the plans and take vigorous enforcement action when polluters do not comply with requirements. The Federal Government should take enforcement action when the States fail to act. Because many polluters do not voluntarily comply with air pollution control laws and regulations, the Administrator of EPA should closely monitor State implementation of plans to determine whether the States are taking adequate enforcement action against polluters not complying with the plans and take appropriate enforcement action when the States fail to act.

1972

35411 **APTIC NO. 57874**

Lave, Lester B.

AIR POLLUTION DAMAGE: SOME DIFFICULTIES IN ESTIMATING THE VALUE OF ABATEMENT. *In: Environmental Quality Analysis. A. V. Kneese and B. T. Bower (eds.), Baltimore, Md., John Hopkins Press, 1972, Chapt. 6, p. 213-242. 40 refs.*

Air pollution damage and the difficulties in estimating the value of abatement are discussed. In estimating the physical damage function, the following are considered: mortality or morbidity, urban factors, and pollution and smoking. Air pollution can take the form of suspended particulates, sulfur compounds, nitrogen compounds, photochemical smog, or various other chemicals. These pollutants can be measured in terms of the largest biweekly measurement throughout the year, the smallest biweekly measurement, and the arithmetic average of the biweekly measurement. A 50% abatement in pollution would add 3-5 yr to the life expectancy of a child born in 1970, or lower the economic cost of all ill health by just under 5%, or would be worth about $2 million/yr in terms of the economic benefits of increased work days and decreased direct health expenditures. (Author summary modified)

35412 **APTIC NO. 57873**

Lukins, Thomas C.

TOP-LEVEL SAFETY MESSAGE TO THE LIME INDUSTRY. *Preprint, National Lime Association, Washington, D. C., 10p., 1972. (Presented at the National Lime Association Annual Convention, 70th, Hot Springs, Va., May 3, 1972.)*

Injury-frequency rates of all lime mines and plants have risen significantly (30%) since 1963. It is inevitable that a marked severity rate increase will follow unless this adverse trend is arrested and reversed by management compliance with the Federal Metal and Nonmetallic Mine Safety Act (P. L. 89-577). This Act provided for the development of Federal Health and safety standards, their applications through mine inspections, enforcement of standards through notices and orders; information gathering and dissemination; and education and training. Enforcement inspections in 1971 revealed the following unsafe conditions common to sand and gravel and crushed stone operations: lack of mechanical safeguards; substandard explosives magazines and lack of fire warning signs in hazardous areas; and unsafe walkways, crossovers, and unguarded openings. The impact of health standards, especially those relating to airborne dust and noise, has not yet been evaluated.

35413 **APTIC NO. 57843**

Russell, Clifford S. and Walter O. Spofford, Jr.

A QUANTITATIVE FRAMEWORK FOR RESIDUALS MANAGEMENT DECISIONS. *In: Environmental Quality Analysis. A. V. Kneese and B. T. Bower (eds.), Baltimore, Md., John Hopkins Press, 1972, Chapt. 4, p. 115-179. 35 refs.*

A quantitative framework designed to assist regional authorities in making decisions about residuals management policies was developed. The framework deals explicitly with airborne, waterborne, and solid residuals and includes, in a linear programming model of regional production, information about internal production process changes, recirculation alternatives, and end of pipe treatment processes with their implications for the form and amount of residual discharges. The discharges were traced through the physical environment by a set of dispersion/diffusion models reflecting the atmospheric and watercourse characteristics of the region. The damages caused by the resulting ambient residuals concentrations, and particularly the marginal damages attributable to individual discharges were calculated, either analytically or numerically. These marginal damages are the link between several submodels and the key to the optimizing method used to solve for the residuals management policy which maximizes a measure of regional welfare. (Author summary modified)

35414 **APTIC NO. 57936**

TRW Transportation and Environmental Operations, Redondo Beach, Calif.

TRANSPORTATION CONTROL STRATEGY DEVELOPMENT FOR THE METROPOLITAN LOS ANGELES REGION. *Environmental Protection Agency Contract 68-02-0048, APTD-1372, 399p., Dec. 1972. 158 refs.*

NTIS: PB-224533/AS

Transportation control strategies for reducing air pollution in the California South Coast Air Basin (Metropolitan Los Angeles Region) were analyzed. Measures were identified which would allow attainment of the national ambient air quality standards promulgated pursuant to the Clean Air Act of 1970. The pollutants of most concern are carbon monoxide, nitrogen dioxide, and photochemical oxidants. The most severe problems come from photochemical oxidants, primarily ozone. The control of O3 is dependent on eliminating the reactive hydrocarbons and nitrogen oxides which lead to its formation. The major findings are photochemical oxidants are substantially above the national ambient air quality standards a significant portion of the time; the geography and meteorology of the area contribute to the severity of the air pollution and the difficulties of its elimination; stationary source contributions to the air pollution problem are much less than those from mobile source; existing and projected alternative modes of transportation are inadequate to handle large increases in ridership; and it will be extremely difficult to reach the air quality standards by 1977 without a massive change in the life styles of the residents. (Author summary modified)

1971

35415 **APTIC NO. 55588**

Matthews, William H.

GLOBAL POLLUTION AND INTERNATIONAL COOPERATION. *In. Man's Impact on the Climate. William H. Matthews, William W. Kellogg, and G. D. Robinson (eds.), Cambridge, MIT Press, 1971, p. 564-579. 13 refs.*

The necessity for international cooperation for the prevention of global pollution is discussed. Global pollution can be attributed to people and technology. The combination of the population explosion and new technological developments accelerated the proliferation of waste products as the energy, food, and other needs of people have been met through technology without centralized regulation. Direct benefits in increased international cooperation include the acquisition of needed scientific data, the development of new technologies for monitoring and abating pollution, and for replacing polluting technologies, and the preservation and enhancement of the global environment through coordinated national action and international agreements.

35416 **APTIC NO. 55535**

Ulbrich, E. A., D. F. Gugeler, R. A. Jones, and G. L. Gearhart

AN APPLICATION OF HYBRID COMPUTATION TECHNIQUES TO AIR POLLUTION CONTROL. *Simulations Councils, Inc., La Jolla, Calif., Simulations Councils Proc. 1971, vol. 1, p. 7-18. 14 refs. (Jan.)*

The development of a hybrid computation technique to air pollution control and its successful application to the Los Angeles basin are described. The overall intent of the simulation model was a system applicable to other areas. Included in the model are geographical meteorological demographic health, chemical, economic and time factors. Four objectives to the program were regional generality, pollution generality, daily flexibility, and tactical and strategic interfacing. Specific pollutations provided for are sulfur dioxide, carbon monoxide, nitrogen dioxide, hydrocarbons, ozone, solid particles, and smoke.

1970

35417 **APTIC NO. 58224**

Better, James W.

ODOR AS AN AIR POLLUTION NUISANCE, NEW YORK STATE. *Air Pollution Control Assoc., Pittsburgh, Pa., Proc. Air Pollution Control Assoc., Mid-Atlantic States Sect., Semi-Annu. Tech. Conf. Odors: Detect., Meas. Control, New Brunswick, N. J., 1970, p. 11-17. 2 refs. (May 13.)*

The history of laws governing public and private nuisances is discussed in general. The concept of nuisance in New York is reviewed. In one case of litigation, several adjacent property owners sought a judgment for money and an injunction against the owner of a cement plant. In this private nuisance situation, the injunction was denied; the court reached this decision by the use of the concept of a servitude on land which was imposed on the plaintiff's property by the dust nuisance produced by the polluter. Several other cases using this concept are mentioned. A second recent New York case involved the use of the public nuisance concept was promulgated in an air pollution control rule. Odors from a piggery were the cause of air pollution complaints from approximately 50 neighbors. Since there were no standards in the area, the court held that there was no valid basis to determine that the piggery owner was polluting the air and that he could not be held responsible for violating a statute when its meaning could not be determined without implementing regulations not yet in existence. This decision provides that the State agency must satisfy all the mandated procedural and planning steps before taking an action.

35418 **APTIC NO. 58204**

Johnson, Walter K.

TRANSPORTATION PLANNING FOR METROPOLITAN AREAS. *Air Pollution Control Assoc., Pittsburgh, Pa., Proc. Air Pollution Control Assoc., Mid-Atlantic States Sect., Semi-Annu. Tech. Conf. Transp. Impact Air Pollut., Harrisburg, Pa., 1970, p. 113-134. (Oct. 8-9.)*

The pollution problem is generally reviewed with emphasis on thy problems of control. The trade-offs between the quality of life and the standards of living must be considered in planning. Transportation planning can be aided by traffic simulations, economic evaluations, land use planning, and presenting the information to the public. The use of the automobile has resulted in highway building as a national policy. A new policy is evolving concerning public transportation for those who cannot drive and for urban commuters. The history of transportation planning, systems planning, and environmental planning are discussed in an effort to describe the need for reordering of priorities and for new policies.

35419 **APTIC NO. 57847**

Kearin, D. H. and R. L. Lamoureux

A SURVEY OF AVERAGE DRIVING PATTERNS IN THE LOS ANGELES URBAN AREA BASED UPON DATA OBTAINED IN A TELEPHONE SURVEY. *Systems Development Corp., Santa Monica, Calif., TM-(L)-4119/005/00, 70p., Dec. 1970. 3 refs.*

NTIS: PB-202193

The average driving patterns in the Los Angeles urban area were analyzed based upon data obtained in a telephone survey. Typical driving patterns are discussed and show that while the patterns previously established by Systems Development Corp. as typicl are present in the telephone survey data, no new patterns can be distinguished. While the telephone survey technique is a valuable way of determining daily usage patterns, it has questionable merit as a method of determining quantitative trip descriptive parameters. The telephone survey data was compared with the data that was compiled on monitor trips carried out as a means of validating the data gathered by telephone. While the data obtained from monitor trips compare reasonably well with the data obtained in this survey, there are many inconsistencies between them and the phone survey data upon which they were based.

35420 **APTIC NO. 58210**

Megonnell, William H.

AIR POLLUTION CONTROL - EVERYONE S RESPONSIBILITY. *Air Pollution Control Assoc., Pittsburgh, Pa., Proc. Air Pollution Control Assoc., Mid-Atlantic States Sect., Semi-Annu. Tech. Conf. Odors Detect., Meas. Control, New Brunswick, N. J., 1970, p. 57-65. (May 13.)*

The increase in public awareness of air pollution, problems and progress of legislation, costs of air pollution control, and air quality standards are reviewed. National air quality and emission standards have been set up by the Federal government. The Clean Air Act has established automobile emission standards.

35421 **APTIC NO. 58202**

Urik, Paul Lawrence

STUDENT AWARD PAPER. PITTSBURGH S FIGHT FOR CLEAR SKIES. *Air Pollution Control Assoc., Pittsburgh, Pa., Proc. Air Pollution Control Assoc., Mid-Atlantic States Sect., Semi-Annu. Tech. Conf. Odors Detect. Meas. Control, New Brunswick, N. J., 1970, p. 95-98. (May 13.)*

Coal burning and topography in Pittsburgh caused a terrible smoke problem. Several ordinances, laws, and regulations were passed which, combined with public concern, finally reduced the major smoke problem. In 1945, legislation was enacted requiring all Pittsburgh industries to use smokeless fuel or to install smoke control equipment. The United Smoke Council was organized to enforce the new legislation. Although the crisis in air pollution in Pittsburgh was corrected by the smoke control legislation of the 1940s, certain sections of the city still experience smog and dust problems.

1969

35422 **APTIC NO. 57909**

Shiozawa, Kiyoshige

RECENT STATUS OF AIR POLLUTION CONTROL IN AMERICA. *(Saikin niokeru beikoku no taikiosenboshi jotai). Text in Japanese. Netsu Kanri (Heat Management: Energy and Pollution Control), 21(2):3-9, Feb. 1969.*

According to the Dept. of Health, Education and Welfare, pollutants from automobiles accounted for 60.6% of total pollutants in 1966, which is one of two major pollutants in the U. S. The other major source of air pollution is combustion of coal. To cope with air pollution, the National Air Pollution Control Administration of the federal governments encourages each state to administer its own air pollution control program, settles disputes between states related to air pollution, gives each state subsidies and technical assistance, monitors the general status of air pollution in the U. S., and formulates air quality criteria. Local governments establish environmental standards for their own areas, supervise air pollution, manage and inspect pollution sources, investigate pollutants peculiar to the areas, and issue pollution warnings. Research on air pollution is being conducted by government institutions to establish environmental standards through clinical study and exposure experiments; and, under government subsidies, at universities in the fields of engineering, zoology, botany, physiology, medicine, and meteorology. To obtain an adequate number of persons trained for air pollution control, education programs are being held at a few universities. More than 30 universities offer air pollution courses at the graduate level, subsidized by the Public Health Service.

1967

35423 **APTIC NO. 58019**

Haydel, Doug

REGIONAL CONTROL OF AIR AND WATER POLLUTION IN THE SAN FRANCISCO BAY AREA. *Calif. Law Rev., vol. 55:702-727, 1967. 209 refs.*

Regional programs were developed for the San Francisco area to resolve air and water pollution problems. The effectiveness of control agencies created at regional and state levels is discussed. The Bay Area Pollution Control District has been successful in locating and regulating the stationary sources of air pollution. The Motor Vehicle Pollution Control Board has had moderate success, being largely hampered by technical problems in control devices and ineffective legislation relating to used cars. The regional approach to water, though imperfect, has been successful in achieving some purity in the state s waters. The problems of consolidation of fragmented sewage treatment systems now in operation are more political than engineering. The conduct and financing of a regional program appear to be major obstacles.

1949

35424 **APTIC NO. 58316**

Allegheny County, Pa.

SMOKE CONTROL ORDINANCE OF ALLEGHENY COUNTY, PENNSYLVANIA. *16p., 1949.*

The smoke control ordinance for Allegheny County, Pa., is presented. The ordinance regulates the production or emission of smoke from any chimney, smokestack or other source within the county, provides for the payment of fees, for examination of plans, the issuing of permits, for inspection of fuel burning devices, the issuing of certificates of compliance, and prescribes the amounts of fines recoverable in prosecutions for violations.

SOCIAL ASPECTS

1972

35425 **APTIC NO. 57844**

Freeman, A. Myrick, III

DISTRIBUTION OF ENVIRONMENTAL QUALITY. *In: Environmental Quality Analysis. A. V. Kneese and B. T. Bower (eds.) Baltimore, Md., John Hopkins Press, 1972, Chapt. 7, p. 243-278. 29 refs.*

The patterns of distribution of environmental pollution and pollution abatement programs are discussed. The major factor influencing the distribution of final product services of the environment from the supply side is whether associated inputs are required to utilize the service. Since air quality is not uniform across a city or region, those areas with higher air quality will be more popular as residence sites. They will be rationed to those with the highest willingness to pay for air quilty. On the demand side the major factors are individual tastes and preferences and, where the services are marketed or require associated inputs, the distribution of wealth. The distribution of the gross benefits associated with the use of the environment as a waste receptor is determined by consumption patterns, and these in turn are largely influe ced by income. In the probable distribution of the benefits of an air pollution abatement program in an urban area, any program to improve air quality will have its largest impact on these areas with the lowest air quality.

GENERAL

1973

35426 **APTIC NO. 57943**

Jensen, Paul

CONTROL OF ENVIRONMENTAL NOISE. *Preprint, Air Pollution Control Assoc., Pittsburgh, Pa., 20p., 1973. 15 refs. (Presented at the Air Pollution Control Association, Annual Meeting, 66th, Chicago, Ill., June 24-28, 1973, Paper 73-195.)*

Regardless of the type of noise source, noise has the basic elements of magnitude, frequency distribution, and sound level distribution. People respond to noise in varying ways depending on many parameters. The effects of noise include physiological effects, speech and sleep interference, and subjective effects. These effects are reviewed. Sources of community noise are discussed including traffic, aircraft, and industries. The major sources are traffic and aircraft which can be controlled by proper design of highways and designing quieter vehicles and by proper design of aircraft engines, retrofit of engines and proper land use, respectively. Noise control in construction can be accomplished by setting criteria, writing good construction specifications, and noise monitoring during actual construction. Industrial noise can be reduced by redesigning the source, modifying the operation, changing plant layout, isolating vibrations, confining the noise in enclosures, setting up barriers to reflect the noise, using surface damping, making material changes on impacted surfaces, adding mufflers, using acoustically lined passages for stock flow, and using acoustic absorption on interior surfaces.

35427 **APTIC NO. 57956**

McRee, Donald I.

BIOLOGICAL EFFECTS OF MICROWAVE RADIATION. *Preprint, Air Pollution Control Assoc., Pittsburgh, Pa., 28p., 1973. 30 refs. (presented at the Air Pollution Control Association, Annual Meeting, 66th, Chicago, Ill., June 24-28, 1973, Paper 73-94.)*

Harmful effects caused by exposure to microwave radiation are reviewed. Biological effects of microwave radiation, sources, and maximum permissible concentrations are described. The biological effects generated by exposure to microwave radiation are usually designated as thermal or nonthermal (specific) in nature. The nonthermal effects are due to direct interaction of the electromagnetic field of the incoming microwave radiation and the biological specimen. The testicles and eyes are most sensitive to elevation in temperature. Nonthermal effects are more difficult to detect than thermal effects. Thy most often reported effects of low level microwave radiation are neurological in nature. Many subjective symptoms in humans working around microwave equipment have been reported. Most of these symptoms are subjective and include headaches, eyestrain, dizziness, fatigue, irritability, nervous tension, metal depression, and other neurological associated effects. Genetic effects have been reported during some experiments. Abnormalities were due to inhibition of cell differentiation caused by a direct interaction with the electromagnetic field rather than

35428 **APTIC NO. 57953**

Powers, John O.

AIRCRAFT NOISE CONTROL: TECHNOLOGY AND REGULATIONS. *Preprint, Air Pollution Control Assoc., Pittsburgh, Pa., 56p., 1973. (Presented at the Air Pollution Control Association, Annual Meeting, 66th, Chicago, Ill., June 24-28, 1973, Paper 73-197.)*

The present status and history of aircraft noise control regulations and technology are described. Technological considerations include basic acoustics, economic factors and aircraft source noise. Public Law 90-411 regulated aircraft noise on a national level. In response to the Congressional mandate provided by P.L. 90-411, the Federal Aviation Agency issued a regulation aimed at stopping escalation of aircraft noise for all subsonic aircraft and for turbojet aircraft. The FAA has set up a program of retrofit feasibility to reduce noise in existing aircraft. The supersonic transport issue is discussed. Future prospects for noise control, costs of noise exposure, and other aspects are mentioned.

35429 **APTIC NO. 57941**

Tyler, John M., Lloyd V. Hinton, and John G. Olin

STATE STANDARDS, REGULATIONS, AND RESPONSIBILITIES IN NOISE POLLUTION CONTROL. *Preprint, Air Pollution Control Assoc., Pittsburgh, Pa., 30p., 1973. 3 refs. (Presented at the Air Pollution Control Association, Annual Meeting, 66th, Chicago, Ill., June 24-28, 1973, Paper 73-192.)*

Comprehensive noise standards for Minnesota are presented for all sources of noise, including airports, highways, and industrial sources for daytime and nighttime. The three dimensions of noise are intensity, frequency, and duration. Standards are established for residential-single family, residential-apartments or public buildings, commercial, manufacturing, and industrial zones. Aircraft noises are quantified by use of the effective perceived noise level which measures single aircraft overflights and the use of the noise exposure forecast which measures the total 24-hour exposure to several aircraft overflights. Duration standards, measured by use of temporal distribution equal to the sound pressure level exceeded x% of the time, are applied to most noises, including industrial and highway noises. An impulse noise standard is applicable to gun shots and detonations. The validity of noise standard curves was verified by applying them to real-life noise distribution curves at two locations in Medford, Mass. An implementation plan for noise abatement is described. Although the Federal Noise Control Act of 1972 gives the U. S. Environmental Protection Agency authority to regulate noise emissions from major noise sources, the states have the power to control the operation of noise sources. (Author abstract modified)

35430

Wesler, J. E. **APTIC NO. 57982**

SURFACE TRANSPORTATION NOISE AND ITS CONTROL. *Preprint, Air Pollution Control Assoc., Pittsburgh, Pa., 10p., 1973. 8 refs. (Presented at the Air Pollution Control Association, Annual Meeting, 66th, Chicago, Ill, June 24-28, 1973, Paper 73-196.)*

Transportation is the dominant source of noise pollution. Reduction of this noise will require careful preparation and enforcement of noise control regulations. Federal noise control regulations and standards are reviewed. Federal authority is limited, and must be complemented by state and local regulations. Much of the noise abatement is within existing knowledge and needs only the incentive to be applied. Regulations will have to provide that incentive, and practical techniques will be documented to guide operation of transportation systems. Several noise control research projects are described which are considering truck noise, truck tire noise, subways and urban rapid transit cars, and wheel-rail contact.

1972

35431

Gershinowitz, H. **APTIC NO. 58280**

THE COMPLEXITY OF ENVIRONMENTAL PROBLEMS. *In: Environmental Quality and Safety: Chemistry, Toxicology and Technology. Frederick Coulston and Friedhelm Korte (eds.), Vol. 1, New York, Academic Press, Inc., 1972, p. 1-9. 6 refs.*

Due to the growth of population, the growth of technology, and increasing urbanization, the rate of man s influence on the environment is increasing too, especially with the introduction of chemical substances which do not exist in nature. Since all of the environment has to be regarded as a natural resource, and since air, water and space are not limitless, science, industry, and governments must interact to reach acceptable and feasible solutions for air pollution criteria of water pollution, eutrophication, and as regards the effects of pollution by pesticides. Methods to minimize these problems are discussed. Control measures for sulfur dioxide and carbon monoxide from industrial sources and hydrocarbons, ozone, CO, particulates, and nitrogen oxides in automobile exhausts are mentioned.

35432

Laulainen, Nels **APTIC NO. 57919**

MINOR GASES IN THE EARTH S ATMOSPHERE: A REVIEW AND BIBLIOGRAPHY OF THEIR SPECTRA. FINAL REPORT. *Washington University, Seattle, Proj. ASTRA, Geophysics, National Science Foundation Grant GP 29339, Rept. U.W.-ASTRA-72-18, 102p., Sept. 1972. 1215 refs.*

NTIS: PB-222 224

A survey of the minor atmospheric gases, including water, carbon dioxide, methane, ozone, carbon monoxide, nitrous oxide, nitrogen oxides, sulfur dioxide, hydrogen sulfide and ammonia is given. Special attention is given to their detection and identification by optical spectroscopic techniques. The abundance, distribution (both vertical and geographical), influence on either the global heat balance or chemical reactions in the atmosphere, lifetime, and any time variation is discussed individually for each constituent. The survey concludes with a brief discussion of areas of atmospheric research, which need continued or increased support. An extensive cross-indexed bibliography of the minor atmospheric gases and their spectra (mainly restricted to the infrared) is also given. The bibliography is sub-divided into a number of reasonably precise and self-explanatory headings. (Author abstract)

1971

35433

Sorvall, Vivian **APTIC NO. 57827**

AIR POLLUTION. THE WORLD S EXHAUST. *West Haven, Conn., Pendulum Press, Inc., 1971. 62p.*

A small booklet on air pollution is presented for the layman as part of an ecology series. Topics covered include: a definition of air pollution, the nature of smog and the weather conditions such as temperature inversion which favor its formation, the role of the automobile as a source of air pollution, the effects of air pollution on human health, the effects of air pollution on atmospheric temperature, and the question of responsibility for air pollution and its abatement.

35434

American Society of Mechanical Engineers, New York **APTIC NO. 57949**

RECOMMENDED GUIDE FOR THE CONTROL OF EMISSION OF OXIDES OF SULFUR COMBUSTION FOR DIRECT HEAT EXCHANGERS. SUPPLEMENT TO ASME STANDARD APS-2. *4p., April 21, 1971.*

A clarification of Appendix B is given for determination of emission standards of sulfur dioxide with respect to multiple and single stacks and stack heights. Examples are given for determining the stack height, sulfur in fuel limit, and maximum sulfur emission in a power plant necessary to limit the ground level concentration to a certain amount.

1970

35435

Nickerson, Bruce G. **APTIC NO. 58283**

STUDENT AWARD PAPER. AIR POLLUTION. *Air Pollution Control Assoc., Pittsburgh, Pa., Proc. Air Pollution Control Assoc., Mid-Atlantic States Sect., Semi-Annu. Tech. Conf. Odors Detect., Meas. Control, New Brunswick, N. J., 1970, p. 89-94. 4 refs. (May 13.)*

Air pollution is generally reviewed. The consumer and industry both cause pollution. Pollutants are the waste products of energy conversions. As society became more industrialized, and more fuel (such as coal) was burned, pollution increased. Although Los Angeles has a smog problem, little seems to be being done about it.

1969

35436

Levitt, Arnold **APTIC NO. 57971**

POLLUTION: CAUSES, COSTS, CONTROLS. *Chem. Eng. News, 47(24):33-68, June 9, 1969.*

The increasing magnitude of the nation s pollution problem stems from two main factors: urbanization and technical advance. Air pollution sources are localized and increasingly concentrated in small areas. Of the pollutants discharged into the atmosphere an estimated 59 9% comes from transportation, 18.7% from manufacturing, 12.5% from power generation, 6.3% from space heating, and 2.6% from refuse burning. Carbon monoxide, chiefly from transportation sources, is the chief pollutant, comprising 52% of the total. Oxides of sulfur, second with 18% are the leading contaminant from industry. Other important contaminants are hydrocarbons, 12%; particulate matter, 10%; oxides of nitrogen, 6%; and other gases and vapors, 2%. Federal laws covering air pollution started with the 1955 Air Pollution Control Act. Federal control was expanded with the Clean Air Act of 1963, its amendments in 1966 and the Air Quality Act of 1967. Under the Air Quality Act, 57 air quality regions including more than 70% of the urban population and all 50 states will have to set up air quality standards and methods of enforcement and have them approved. Water pollution is discussed. Companies which provide pollution control equipment are listed.

GENERAL

35437 **APTIC NO. 57892**

Vigy, M.

ATMOSPHERIC POLLUTION. *(La pollution atmospherique). Text in French. Concours Med. (Paris), 91(5):802-809, Feb. 1969.*

Sources of air pollution, their effect on human health, and methods of prevention are reviewed. Types of gaseous pollutants discussed are the sulfur oxides, carbon monoxide, and nitrogen oxides. Solid and liquid particles in suspension constitute smoke and fog, a portion of which may contain carcinogenic compounds. Some pollutants behave as allergens, but most promote respiratory ailments and lung cancer. Measures to combat air pollution must include an international standard of tolerance norms, which so far have been established only for radioactivity. Some of the problems involved in controlling the three major sources of pollution (motor vehicles, industry and home heating) are considered. It is hoped that rational city planning will be undertaken, especially in the areas of rapid transport to discourage private vehicle traffic and the creation of parks for the natural detoxication of polluted air. New cities should have industrial plants at one end and residences at the other, with the main axis perpendicular to the dominant winds for the rapid dissipation of pollutants.

1968

35438 **APTIC NO. 57818**

Rahlenbeck, U. and W. Seidl

MEETING OF THE ASSOCIATION OF LARGE BOILER OWNERS ON EMISSIONS. *(VGB-Fachtagung Emissionen). Text in German. Brennstoff-Waerme- Kraft, 20(12):588-589, Dec. 1968. 3 refs.*

The most interesting things discussed at the meeting of the Association of Large Boiler Owners in Essen, West Germany are briefly outlined. In a paper dealing with the importance of high stacks in air pollution, it was said that although waste gases of power plants generally contain no more than 0.2% by weight of sulfur dioxide, one plant with a capacity of 300 MW emits 3.6 tons/hr of SO_2, which doubles the SO_2 concentration in the surrounding atmosphere. Since there are no methods which would remove these enormous amounts of SO_2 from the stack gases, they must be emitted into the atmosphere through high stacks. The stack height necessary to guarantee sufficient dilution of the gases is computed with the so-called dispersion computation. According to regulations, the maximum SO_2 concentration in the atmosphere may not exceed 0.75 mg/cu m. The dispersion calculation, however, helps only under normal weather conditions and fails during inversions. Furthermore, the meteorological parameters vary among power plants. Suggestions for the improvement of the dispersion calculation have been given elsewhere. In a second paper, the problem of noise abatement in power plants was discussed. Construction of new power plants will be authorized only if the regulations concerning noise abatement are met.

1955

35439 **APTIC NO. 57870**

Murk, Janet B.

SOURCES OF AIR POLLUTION LITERATURE. *Ind. Eng. Chem., 47(5):976- 981, 1955. 105 refs.*

A bibliography of bibliographies on air pollution has been prepared to promote awareness of problems encountered in combating pollution and steps being taken to improve the situation. Legislation, institutional work, and symposia are cited. Samples of the many headings used for indexing air pollution literature are listed to facilitate further search. Publications devoting space to air pollution and nomenclature problems inherent in the topic are also considered.

SUBJECT INDEX

A

ABATEMENT
35000, 35237, 35382, 35411, 35412, 35415, 35418, 35425

ABSORPTION
34930, 34954, 34965, 34966, 34973, 35039, 35041, 35047, 35051, 35100, 35102, 35107, 35216, 35230, 35231, 35233, 35243, 35246, 35248, 35258, 35286, 35311, 35313, 35324, 35325, 35367

ABSORPTION (GENERAL)
34951, 34969, 34983, 34988, 34990, 35015, 35016, 35017, 35020, 35021, 35039, 35042, 35049, 35052, 35053, 35063, 35065, 35076, 35079, 35081, 35098, 35102, 35106, 35109, 35113, 35118, 35311, 35314, 35316, 35324, 35326, 35364

ACETYLENES
34907, 35087, 35163, 35325

ACROLEIN
35352

ACUTE
35362

ADSORPTION
34965, 34966, 34973, 34980, 35005, 35026, 35041, 35051, 35088, 35104, 35115, 35305, 35320, 35321, 35324

ADSORPTION (GENERAL)
34988, 35044, 35063, 35065, 35073, 35077, 35080, 35098, 35364

ADVISORY SERVICES
35398

AERODYNAMICS
35239

AEROSOL GENERATORS
35151, 35295

AEROSOLS
34968, 35004, 35047, 35092, 35119, 35121, 35130, 35142, 35146, 35147, 35151, 35152, 35159, 35176, 35178, 35179, 35185, 35194, 35221, 35224, 35225, 35228, 35238, 35240, 35243, 35248, 35251, 35252, 35256, 35265, 35270, 35273, 35275, 35329, 35351

AFRICA
35049

AFTERBURNERS
34899, 34901, 34909, 34914, 34952, 34961, 34970, 34973, 35011, 35019, 35027, 35035, 35043, 35045, 35057, 35101

AIR CONDITIONING EQUIPMENT
34995, 35063

AIR POLLUTION FORECASTING
35219, 35229, 35230, 35233, 35235, 35236, 35242, 35254, 35255, 35261, 35294

AIR QUALITY CRITERIA
35166, 35364, 35393, 35431

AIR QUALITY MEASUREMENT PROGRAMS
34908, 34917, 34927, 34935, 35166, 35192, 35193, 35197, 35198, 35199, 35200, 35201, 35203, 35204, 35219, 35238, 35328, 35346, 35365, 35369, 35374, 35398, 35402, 35405, 35408, 35409, 35419, 35422

AIR QUALITY STANDARDS
34914, 34976, 35136, 35202, 35204, 35384, 35389, 35391, 35393, 35394, 35395, 35400, 35410, 35414, 35420

AIR RESOURCE MANAGEMENT
34994, 35398, 35399, 35402, 35411, 35413, 35415, 35416, 35418, 35425, 35431, 35433

AIR-FUEL RATIO
34952, 34960, 34970, 35058, 35061

AIRCRAFT
34915, 35035, 35209, 35224, 35226, 35240, 35248, 35249, 35252, 35406, 35407, 35426, 35428, 35429

AIRPORTS
34914, 34915, 35237

AITKEN COUNTERS
35288

ALCOHOLS
34897, 35300, 35304, 35305

ALDEHYDES
34904, 35055, 35061, 35141, 35144, 35201, 35205, 35267, 35352

ALKALINE ADDITIVES
34969, 35076, 35079, 35106, 35314, 35364

ALKALIZED ALUMINA (ADSORPTION)
35078, 35364

ALLERGIES
35363

ALUMINUM
34903, 34947, 35385

ALUMINUM COMPOUNDS
35197, 35316

ALUMINUM OXIDES
35334

AMIDES
35377

AMINES
35155, 35352

AMMONIA
34906, 35044, 35084, 35106, 35154, 35155, 35167, 35221, 35278, 35308, 35325, 35432

AMMONIUM COMPOUNDS
34906, 35044, 35084, 35106, 35132, 35154, 35155, 35167, 35194, 35221, 35257, 35278, 35308, 35325, 35432

ANIMALS
34906, 34991, 35112, 35234, 35329, 35330, 35331, 35334, 35336, 35339, 35343, 35345, 35349, 35351, 35355, 35356, 35358, 35361, 35373

ANTIGENS
35361

AREA SURVEYS
34908, 34917, 34927, 34935, 35192, 35193, 35197, 35198, 35199, 35200, 35201, 35204, 35219, 35238, 35328, 35365, 35369, 35374, 35405

ARIZONA
35369, 35404

AROMATIC HYDROCARBONS
35128, 35139, 35163, 35304, 35321

ASBESTOS
35329, 35384

ASBESTOSIS
35344

ASHES
34944, 35103

ASPHALT
35385

ASPIRATORS
35178

ASTHMA
35365

ATMOSPHERIC MOVEMENTS
35161, 35194, 35197, 35200, 35203, 35206, 35208, 35215, 35218, 35219, 35220, 35225, 35229, 35238, 35239, 35241, 35247, 35252, 35254, 35255, 35259, 35261, 35262, 35408

AUSTRALIA
34957, 34976, 35119, 35234, 35243, 35245, 35246, 35250, 35375, 35391

AUTOMOBILES
34925, 34928, 34929, 34943, 34960, 35000, 35001, 35074, 35136, 35249, 35357, 35385, 35388, 35406, 35418, 35429

AUTOMOTIVE EMISSION CONTROL
34899, 34902, 34904, 34907, 34909, 34913, 34929, 34952, 34958, 34960, 34970, 34996, 34997, 34998, 34999, 35000, 35001, 35006, 35011, 35012, 35014, 35027, 35045, 35055, 35058, 35061, 35066, 35074, 35088, 35101, 35391, 35406

AUTOMOTIVE EMISSIONS
34899, 34902, 34904, 34907, 34909, 34910, 34913, 34914, 34915, 34916, 34925, 34928, 34931, 34943, 34952, 34958, 34960, 34970, 34978, 34989, 34996, 34997, 34998, 34999, 35000, 35006, 35011, 35012, 35014, 35027, 35035, 35036, 35043, 35045, 35055, 35058, 35061, 35066, 35074, 35088, 35101, 35134, 35141, 35144, 35145, 35186, 35192, 35205, 35224, 35226, 35249, 35267, 35342, 35357, 35383, 35385, 35390, 35406, 35407, 35408, 35420, 35433

B

BACTERIA
35231, 35289, 35359, 35366

BAG FILTERS
35004, 35018, 35028, 35030, 35047, 35057, 35071, 35072

BARIUM COMPOUNDS
35036, 35118

BASIC OXYGEN FURNACES
34982

BELGIUM
35142

BENZENE-SOLUBLE ORGANIC MATTER
35192, 35199

BENZENES
35163, 35321

BENZO(3-4)PYRENE
35199, 35334

BENZOPYRENES
34902, 35199, 35334

BERYLLIUM
35384

BERYLLIUM COMPOUNDS
35384

BESSEMER CONVERTERS
35108

BETA PARTICLES
35137

BIOCLIMATOLOGY
35363, 35374

BLACK LIQUOR OXIDATION
34934, 34938, 34984, 35085

BLAST FURNACES
34982, 35108

BLOOD CHEMISTRY
35337, 35345, 35354, 35357

BLOOD PRESSURE
35336

BLOOD VESSELS
35342

BLOWBY
34997

BODY FLUIDS
35361

BOILERS
34900, 34903, 34929, 34944, 34950, 34971, 35079, 35103, 35438

BONES
35357

BORON COMPOUNDS
35161, 35299

BROMINE COMPOUNDS
35132

BRONCHI
35338, 35348, 35358, 35361

BRONCHITIS
35338, 35340, 35359, 35365

BUDGETS
35380, 35399

BUILD-UP RATES
35234

BUILDINGS
34916, 34995, 35258, 35261

BUSES
35061, 35385, 35406

BUTENES
35267

BY-PRODUCT RECOVERY
34935, 34941, 34942, 34948, 34957, 34962, 34982, 34984, 34987, 34988, 35015, 35016, 35017, 35020, 35021, 35026, 35039, 35041, 35042, 35044, 35049, 35052, 35054, 35070, 35075, 35077, 35078, 35080, 35081, 35082, 35084, 35095, 35098, 35099, 35100, 35102, 35106, 35109, 35110, 35111, 35113, 35118

C

CADMIUM COMPOUNDS
35111, 35150, 35193, 35197, 35354, 35372

CALCIUM COMPOUNDS
34965, 34966, 34969, 35075, 35076, 35092, 35322, 35326

CALCIUM SULFATES
35075, 35322

CALIBRATION METHODS
34951, 35114, 35130, 35144, 35179, 35182, 35185, 35244, 35393

CALIFORNIA
34908, 35121, 35192, 35333, 35365, 35414, 35416, 35419, 35423, 35435

CANADA
34948, 34968, 35085, 35095, 35099, 35109, 35171, 35187, 35236, 35361, 35368

CANCER
35334, 35340, 35351, 35352

CARBON BLACK
34902, 34932, 34977, 35044, 35063, 35073, 35080, 35083, 35104, 35146, 35211, 35213, 35223, 35230, 35233, 35293, 35300, 35320, 35334

CARBON DIOXIDE
34897, 34901, 34924, 34930, 34961, 35134, 35141, 35144, 35163, 35200, 35217, 35223, 35224, 35230, 35233, 35234, 35235, 35268, 35289, 35321, 35325, 35327, 35432

CARBON DISULFIDE
35050, 35268, 35283, 35321

CARBON MONOXIDE
34901, 34904, 34905, 34909, 34910, 34925, 34935, 34946, 34952, 34958, 34960, 34961, 34980, 34989, 34997, 35000, 35043, 35045, 35055, 35061, 35066, 35122, 35134, 35136, 35141, 35144, 35145, 35166, 35167, 35183, 35231, 35263, 35267, 35269, 35278, 35289, 35307, 35314, 35327, 35335, 35336, 35341, 35355, 35367, 35385, 35391, 35393, 35408, 35414, 35432

CARBON TETRACHLORIDE
35321

CARBONATES
34965, 34966, 35015, 35016, 35017, 35020, 35021, 35112, 35132

CARBONYLS
35087, 35268

CARBOXYHEMOGLOBIN
35335, 35341

CARBURETION
34952, 35058

CARBURETOR EVAPORATION LOSSES
34997

CARCINOGENS
35334, 35340

CARDIOVASCULAR DISEASES
35335

CASCADE SAMPLERS
34980, 35132, 35159, 35302

CATALYSIS
34946, 34952, 34971, 34978, 34980, 34987, 34989, 35008, 35027, 35038, 35040, 35043, 35045, 35050, 35089, 35090, 35091, 35093, 35094, 35098, 35101, 35117, 35149, 35263, 35278, 35284, 35305, 35308, 35364

CATALYSTS
34946, 34978, 34980, 34987, 34989, 35008, 35027, 35038, 35040, 35043, 35045, 35050, 35089, 35090, 35093, 35094, 35098, 35101, 35117, 35149, 35263, 35278, 35284, 35305

CATALYTIC ACTIVITY
34952, 35278

CATALYTIC AFTERBURNERS
34901, 34914, 34952, 35011, 35019, 35027, 35043, 35045, 35101

CATALYTIC OXIDATION
34902, 34934, 34938, 34978, 34980, 34984, 34988, 34989, 35005, 35024, 35025, 35027, 35043, 35052, 35062, 35084, 35085, 35087, 35098, 35117, 35149, 35318, 35364

CATTLE
34906

CELL GROWTH
35328

CELL METABOLISM
35339

CELLS
35329, 35350, 35358, 35361

CEMENTS
34932, 35037, 35064, 35356, 35385, 35417

CENTRIFUGAL SEPARATORS
35023, 35037, 35046, 35057, 35064, 35097, 35386

CERAMICS
34952

CHARCOAL
35031, 35321

CHEMICAL BONDS
35269, 35300

CHEMICAL COMPOSITION
34898, 34902, 34913, 35121, 35123, 35127, 35132, 35150, 35152, 35157, 35164, 35181, 35192, 35193, 35194, 35199, 35202, 35218, 35257, 35372, 35392

CHEMICAL METHODS
35147, 35150, 35159, 35164, 35166, 35168, 35171, 35183, 35187, 35189, 35227, 35337

CHEMICAL PROCESSING
34896, 34931, 34932, 34934, 34938, 34946, 34948, 34957, 34964, 34971, 34972, 34973, 34984, 34988, 35040, 35042, 35082, 35085, 35090, 35091, 35093, 35097, 35099, 35105, 35106, 35162, 35187, 35284, 35340, 35385

CHICAGO
35150

CHLORATES
35295

CHLORIDES
34947, 35154, 35167, 35193, 35295

CHLORINATED HYDROCARBONS
35167, 35321

CHLORINE
34937, 34947, 35362

CHLORINE COMPOUNDS
34947, 35154, 35167, 35193, 35295

CHROMATOGRAPHY
34981, 35128, 35144, 35152, 35155, 35165, 35172, 35188, 35196, 35215

CHROMIUM COMPOUNDS
35193, 35264, 35306, 35372

CHROMIUM OXIDES
35329

CHRYSENES
35192

CIRCULATORY SYSTEM
35342, 35361

CITIZENS GROUPS
35405

CLEAN AIR ACT
35396, 35410, 35414, 35436

CLOUDS
35219, 35224, 35228, 35230, 35240, 35243, 35245, 35246, 35249, 35250, 35251, 35259

COAL
34900, 34903, 34922, 34927, 34940, 34944, 34962, 34976, 34983, 34985, 34995, 35060, 35069, 35070, 35096, 35103, 35108, 35113, 35131, 35137, 35164, 35312, 35340, 35381, 35392

COAL CHARACTERISTICS
34944, 35070, 35096, 35103, 35392

COAL PREPARATION
34919, 34932, 34956, 34962, 34974, 34983, 35070, 35086, 35096, 35102, 35110, 35115, 35364, 35381

COBALT COMPOUNDS
35264, 35343

COKE
34932, 34964, 34993, 35069, 35340

COLLECTORS
34985, 35023, 35037, 35046, 35056, 35057, 35064, 35097, 35111, 35114, 35386

COLORIMETRY
35144, 35153, 35166, 35168, 35181, 35182, 35277

COMBUSTION
34899, 34904, 34905, 34910, 35304, 35312

COMBUSTION AIR
34918, 34950, 34953, 34956, 34961, 35006, 35025, 35103

COMBUSTION PRODUCTS
34896, 34897, 34901, 34903, 34905, 34912, 34927, 34930, 34931, 34937, 34938, 34941, 34942, 34944, 34945, 34946, 34950, 34951, 34953, 34954, 34955, 34957, 34962, 34964, 34968, 34969, 34971, 34972, 34974, 34975, 34977, 34981, 34982, 34983, 34984, 34988, 34990, 34993, 34994, 35013, 35015, 35016, 35017, 35019, 35020, 35021, 35024, 35025, 35028, 35040, 35041, 35042, 35044, 35050, 35051, 35052, 35053, 35057, 35059, 35060, 35062, 35063, 35065, 35072, 35073, 35075, 35076, 35077, 35078, 35079, 35080, 35081, 35083, 35084, 35085, 35088, 35089, 35090, 35091, 35093, 35094, 35097, 35098, 35099, 35100, 35102, 35103, 35104, 35105, 35106, 35107, 35109, 35110, 35111, 35113, 35117, 35118, 35122, 35131, 35140, 35143, 35145, 35154, 35162, 35164, 35177, 35180, 35189, 35234, 35239, 35260, 35261, 35312, 35321, 35342, 35346, 35364, 35381, 35385, 35404, 35424, 35428

COMMERCIAL EQUIPMENT
34983, 35105

COMMERCIAL FIRMS
35398, 35436

COMPLIANCE
35344, 35408, 35404

COMPRESSION
35064

COMPUTER PROGRAMS
34988, 35157, 35198, 35306, 35398, 35413

COMPUTERS
35128, 35129, 35198, 35232, 35387

CONDENSATION
34920, 34973, 34987, 35155, 35249, 35270, 35276, 35288, 35289

CONDENSATION (ATMOSPHERIC)
35176, 35219, 35222, 35224, 35228, 35237, 35238, 35240, 35243, 35245, 35246, 35249, 35250, 35251, 35259

CONSTRUCTION MATERIALS
34932, 35037, 35084, 35304, 35325, 35336, 35379, 35385, 35412, 35417

CONTACT PROCESSING
35042, 35106

CONTINUOUS MONITORING
35122, 35162, 35163, 35166, 35227, 35385

CONTROL AGENCIES
35409, 35421, 35422, 35423

CONTROL PROGRAMS
34962, 34994, 34999, 35400, 35403, 35406, 35407, 35410, 35412, 35414, 35416, 35422, 35423, 35424, 35429, 35437

CONTROLLED ATMOSPHERES
34930

CONVECTION (ATMOSPHERIC)
35238

COOLING
34963, 35013, 35251

COOLING TOWERS
34963

COPPER
34987, 35049, 35054, 35109, 35385

COPPER COMPOUNDS
35150, 35193, 35197, 35264, 35372

CORONA
34949

CORROSION
35375, 35376, 35378, 35405

COSTS
34901, 34908, 34915, 34918, 34919, 34930, 34939, 34940, 34947, 34953, 34956, 34957, 34969, 34974, 34975, 34982, 34983, 34986, 34987, 34990, 35023, 35048, 35060, 35064, 35070, 35081, 35082, 35099, 35101, 35110, 35116, 35122, 35167, 35380, 35381, 35382, 35384, 35385, 35386, 35387, 35411, 35420, 35428, 35436

COTTON GINNING
34932

COUGH
35333, 35365

COUNTY GOVERNMENTS
35108, 35424

CRANKCASE EMISSIONS
34897, 35012

CRANKCASE VENTILATION AIR
34897

CRITERIA
35154, 35166, 35364, 35393, 35431

CROP SPRAYING
35010

CROPS
34930, 35288, 35367

CUMULATIVE METHODS
35135

CYANIDES
35154, 35313

CYCLIC ALKANES
34987, 35128, 35140

CZECHOSLOVAKIA
35308, 35314

D

DATA ANALYSES
35402, 35416

DATA HANDLING SYSTEMS
34988, 35157, 35166, 35198, 35219, 35306, 35398, 35399, 35402, 35408, 35413, 35416

DECISIONS
35403, 35417

DECOMPOSITION
34910, 34945, 35101, 35213, 35269, 35301, 35317, 35345

DEGREASING
34973

DENMARK
35363

DEPOSITION
35151, 35206, 35207, 35208, 35216, 35251, 35258, 35302, 35372

DESULFURIZATION OF FUELS
34919, 34932, 34955, 34957, 34962, 34972, 34974, 34983, 34986, 34994, 35008, 35060, 35070, 35086, 35096, 35102, 35110, 35115, 35364, 35381

DIAGNOSIS
35354

DIESEL ENGINES
34904, 34909, 34916, 35036, 35061, 35144, 35390

DIFFRACTION
35329

DIFFUSION
34968, 34995, 35002, 35161, 35198, 35200, 35208, 35209, 35210, 35212, 35213, 35214, 35215, 35217, 35220, 35226, 35227, 35229, 35232, 35236, 35239, 35241, 35242, 35247, 35255, 35261, 35271, 35275, 35276, 35304, 35404, 35413

DIFFUSION MODELS
35198, 35200, 35210, 35212, 35215, 35217, 35226, 35229, 35232, 35236, 35241, 35242, 35255, 35261, 35275, 35404, 35413

DIGESTERS
34988, 35105

DIOLEFINS
35296

DISSIPATION RATES
35234

DISSOCIATION
35300, 35301, 35341

DISTILLATE OILS
34903, 34974

DOMESTIC HEATING
34922, 34931, 34961, 34971, 35103

DROPLETS
35176, 35280, 35288

DRUGS
35331

DRY CLEANING
34973, 35406

DRYING
34955, 34991, 35056, 35112

DUST FALL
34920, 35195, 35202, 35204, 35372, 35405

DUSTS
34920, 34922, 34931, 34949, 34975, 34976,
34982, 34985, 35007, 35022, 35026, 35029,
35030, 35032, 35034, 35037, 35046, 35047,
35048, 35056, 35059, 35064, 35068, 35069,
35071, 35072, 35108, 35111, 35114, 35160,
35166, 35169, 35195, 35197, 35202, 35276,
35290, 35302, 35334, 35366, 35370, 35374,
35386, 35387, 35394, 35408, 35412, 35417

DYNAMOMETERS
35390

E

ECONOMIC LOSSES
35382

EDUCATION
35201, 35398, 35412, 35422

ELECTRIC FURNACES
34975, 34982

ELECTRIC POWER PRODUCTION
34908, 34922, 34924, 34933, 34936, 34939,
34940, 34953, 34963, 34971, 34974, 34983,
35060, 35076, 35081, 35131, 35136, 35137,
35143, 35164, 35260, 35364, 35381, 35385,
35400, 35404, 35434

ELECTRIC PROPULSION
34974, 34999, 35074, 35397

ELECTRICAL PROPERTIES
34949, 35151, 35168, 35179, 35222, 35319,
35320

ELECTRICITY (ATMOSPHERIC)
35222, 35253, 35319, 35363

ELECTROCHEMICAL METHODS
35147, 35150, 35159, 35166, 35168, 35171,
35183, 35187, 35227

ELECTROCONDUCTIVITY ANALYZERS
35166, 35305

ELECTROLYSIS
34912, 35054, 35095

ELECTRON MICROSCOPY
35119, 35329

ELECTROSTATIC PRECIPITATORS
34949, 34959, 34962, 34984, 34987, 35007,
35022, 35023, 35031, 35033, 35037, 35047,
35059, 35064, 35082, 35106, 35111, 35116,
35251, 35386, 35387

EMISSION INVENTORIES
34927, 34985

EMISSION STANDARDS
34950, 34990, 35136, 35164, 35365, 35380,
35391, 35394, 35397, 35400, 35403, 35404,
35407, 35420, 35434

ENFORCEMENT PROCEDURES
35410, 35412, 35424

ENGINE DESIGN MODIFICATION
34913, 34958, 34970, 34999, 35035, 35061,
35066, 35074

ENGINE OPERATING CYCLES
34902, 34909, 34943, 34952, 35020, 35053,
35141, 35419

ENGINE OPERATION MODIFICATION
34904, 34907, 34913, 34952, 34960, 34970,
34997, 34999, 35006, 35014, 35038, 35061

ENZYMES
35330, 35339, 35353

EPIDEMIOLOGY
35333, 35335, 35340, 35355, 35360, 35362,
35363, 35366

EQUIPMENT CRITERIA
35154

EQUIPMENT STANDARDS
35114, 35154, 35394

ERYTHEMA
35356

ETHYLENE
34987, 35149, 35163, 35203, 35304, 35352

EUROPE
34906, 34916, 34917, 34922, 34925, 34929,
34931, 34934, 34937, 34946, 34955, 34963,
34969, 34970, 34977, 34978, 34988, 35007,
35009, 35011, 35022, 35026, 35035, 35041,
35042, 35046, 35047, 35051, 35053, 35056,
35057, 35058, 35060, 35062, 35064, 35065,
35067, 35069, 35076, 35077, 35079, 35080,
35082, 35083, 35096, 35100, 35103, 35110,
35117, 35124, 35128, 35130, 35138, 35140,
35142, 35151, 35160, 35166, 35172, 35176,
35177, 35178, 35189, 35194, 35195, 35202,
35203, 35204, 35206, 35207, 35209, 35214,
35220, 35221, 35224, 35236, 35237, 35239,
35241, 35247, 35253, 35254, 35255, 35256,
35258, 35261, 35262, 35270, 35273, 35277,
35279, 35280, 35283, 35286, 35289, 35294,
35308, 35311, 35313, 35314, 35315, 35316,
35321, 35322, 35324, 35325, 35332, 35336,
35342, 35344, 35345, 35347, 35348, 35350,
35354, 35356, 35357, 35359, 35360, 35363,
35366, 35372, 35374, 35378, 35379, 35386,
35387, 35394, 35405, 35437, 35438

EVAPORATORS
34938, 34984

EXCESS AIR
34950, 34961

EXHAUST SYSTEMS
34964, 34976, 35048, 35069

EXPERIMENTAL EQUIPMENT
35744, 35325

EXPERIMENTAL METHODS
35147, 35325, 35329

EXPOSURE METHODS
35331, 35339, 35343, 35349, 35358, 35361,
35375

EYE IRRITATION
35333

EYES
35427

F

FALLOUT
35190, 35191, 35226, 35357

FANS (BLOWERS)
34976, 35069

FARMS
34906, 34930

FEASIBILITY STUDIES
34986, 35252

FEDERAL GOVERNMENTS
35397, 35399, 35400, 35401, 35403, 35404,
35407, 35410, 35412, 35430

FEES
34994, 35424

FERROALLOYS
34927, 34932, 35366, 35378

FERTILIZER MANUFACTURING
35100, 35385

FIELD TESTS
35135, 35137, 35207

FILTER FABRICS
34967, 35009, 35023, 35029, 35037, 35068,
35097, 35139, 35387

FILTERS
34947, 34962, 34967, 34973, 35004, 35009,
35012, 35018, 35023, 35028, 35029, 35030,
35031, 35032, 35034, 35037, 35047, 35057,
35059, 35064, 35068, 35069, 35071, 35072,
35097, 35137, 35139, 35152, 35178, 35386,
35387

FINLAND
35348, 35372

FIRING METHODS
34918, 34950, 34953, 34956, 34961, 34962,
34971, 34975, 34977, 34993, 35006, 35025,
35060, 35103, 35105, 35381

FLAME AFTERBURNERS
34901, 34961

FLAME IONIZATION DETECTOR
34901, 35144, 35166, 35172, 35186

FLARES
34973

FLOW RATES
35206, 35207, 35208, 35290, 35303

FLOWERS
35201

FLUID FLOW
34905, 35033, 35059, 35145, 35206, 35207,
35208, 35245, 35285, 35286, 35288, 35290,
35292, 35302, 35303

FLUORESCENCE
35132, 35133, 35146, 35156

FLUORIDES
35171, 35194, 35373

FLUORINE COMPOUNDS
35171, 35194, 35373

FLY ASH
34944, 35079, 35103

FOG
35176, 35224, 35237, 35243, 35259

FOOD AND FEED OPERATIONS
34897, 34930, 34932, 34972, 35024, 35025, 35048, 35112, 35385, 35417

FORESTS
35203, 35369, 35374

FORMALDEHYDES
35055, 35141, 35352

FRACTIONATION
35142

FRANCE
34925, 34977, 34980, 35042, 35124, 35128, 35160, 35178, 35236, 35239, 35253, 35289, 35336, 35356, 35437

FREE RADICALS
35119, 35267, 35272, 35273, 35282

FREEZING
35251

FROTH FLOATATION
35070

FUEL ADDITIVES
34944, 34996, 35036

FUEL CELLS
34974, 35074

FUEL EVAPORATION
34997

FUEL GASES
34903, 34908, 34919, 34923, 34940, 34945, 34960, 34979, 34982, 34986, 34998, 34999, 35040, 35041, 35051, 35087, 35090, 35093, 35094, 35102, 35110, 35115, 35116, 35279, 35285

FUEL OIL PREPARATION
34983, 35008, 35038

FUEL OILS
34903, 34908, 34919, 34927, 34940, 34950, 34974, 34983, 34998, 35008, 35038, 35055, 35284

FUEL STANDARDS
35383, 35388, 35392, 35434

FUEL TANK EVAPORATION
34997

FUMES
34898, 34931, 34947, 34982, 35007, 35111

FUNGI
35348

FURNACES
34896, 34905, 34945, 34947, 34950, 34961, 34962, 34975, 34982, 34983, 34987, 35007, 35024, 35025, 35026, 35060, 35072, 35102, 35105, 35108, 35114, 35312

G

GAMMA RADIATION
35126

GAS CHROMATOGRAPHY
34901, 35128, 35144, 35152, 35155, 35166, 35172, 35180, 35186, 35215

GAS SAMPLING
34902, 35122, 35128, 35144, 35155, 35215, 35346

GAS TURBINES
34911, 34958, 34999, 35055, 35066, 35144, 35364

GASIFICATION (SYNTHESIS)
34919, 34956, 34974, 34983, 35102, 35110, 35115, 35364

GASOLINES
34908, 34916, 34996, 35350, 35371, 35383, 35388, 35406

GENETICS
35352, 35356, 35427

GERMANY
34922, 34937, 34955, 34963, 34970, 34980, 35022, 35035, 35041, 35051, 35057, 35058, 35064, 35067, 35076, 35079, 35083, 35140, 35166, 35172, 35177, 35203, 35204, 35209, 35214, 35224, 35241, 35280, 35374, 35378, 35438

GLANDS
35427

GLASS
35324, 35325, 35379

GLASS FABRICS
34967, 35097, 35139

GOBPILE BURNING
35108

GRAIN PROCESSING
34897, 34932, 35048, 35385

GRASSES
35208

GREAT BRITAIN
34917, 34931, 34978, 35011, 35060, 35077, 35080, 35110, 35117, 35189, 35194, 35206, 35207, 35236, 35237, 35258, 35261, 35262, 35270, 35273, 35311, 35321, 35324, 35325, 35332, 35345, 35357, 35359, 35387, 35405

GROUND LEVEL
34917, 35206, 35227, 35255, 35261, 35262, 35434

GUINEA PIGS
35336, 35361

H

HALOGEN GASES
34937, 34947, 35161, 35362

HALOGENATED HYDROCARBONS
35167, 35299, 35321

HAMSTERS
35329, 35334, 35343

HAWAII
34898, 35200

HAYFEVER
35365

HEADACHE
35333

HEALTH IMPAIRMENT
34926, 35328, 35333, 35338, 35339, 35347, 35365, 35411, 35433

HEALTH STATISTICS
35332, 35411

HEARINGS
35400

HEART
35342, 35361

HEAT TRANSFER
34955, 34963, 35013, 35060, 35251, 35285

HEIGHT FINDING
35434

HEMATOLOGY
35335, 35337, 35341, 35345, 35354, 35357

HERBICIDES
35291, 35352

HEXANES
35055

HI-VOL SAMPLERS
35142

HIGHWAYS
35192

HISTAMINES
35336

HUMIDITY
34966, 35219, 35220, 35243, 35259, 35270, 35375, 35376, 35378, 35408

HYDRAZINES
35299, 35301, 35345

HYDROCHLORIC ACID
35258

HYDRODESULFURIZATION
35008, 35038

HYDROFLUORIC ACID
35166

HYDROGEN
34902, 34946, 34947, 34974, 35094, 35146, 35272, 35278, 35289, 35293, 35300

HYDROGEN SULFIDE
34938, 34946, 34948, 34984, 34986, 35015, 35020, 35021, 35039, 35041, 35051, 35102, 35122, 35154, 35155, 35166, 35211, 35216, 35268, 35282, 35432

HYDROGENATION
34919

HYDROLYSIS
35291

HYDROSPHERE
35223, 35225, 35230, 35234, 35235, 35243

HYDROXIDES
35267, 35281, 35282, 35289, 35326

HYPERVENTILATION
35361

HYPOXIA
35336

I

ICE
35244, 35249, 35251

IDAHO
35389, 35396

ILLINOIS
35150

IMMUNOLOGY
35356, 35361

INCINERATION
34918, 34935, 34971, 34973, 34977, 34988, 35023, 35085, 35105, 35136, 35385

INDIANA
35238

INDOOR
34916, 34920, 35258

INDUSTRIAL AREAS
34977, 35192, 35193, 35195, 35202, 35205, 35250, 35366, 35368, 35374, 35384, 35429

INERTIAL SEPARATION
35302

INFLUENZA
35359

INFRARED RADIATION
34943, 35158, 35256

INFRARED SPECTROMETRY
34943, 35124, 35131, 35132, 35134, 35143, 35144, 35158, 35166, 35217, 35313, 35432

INHIBITION
35336

INORGANIC ACIDS
34898, 34932, 34957, 34972, 35021, 35040, 35042, 35044, 35049, 35075, 35080, 35081, 35084, 35089, 35090, 35091, 35097, 35106, 35109, 35112, 35119, 35166, 35258, 35270, 35280, 35289, 35323, 35385

INSPECTION
35029, 35154, 35388, 35390, 35412, 35424

INSTRUMENTATION
34949, 34951, 35114, 35120, 35122, 35125, 35131, 35136, 35137, 35138, 35144, 35145, 35149, 35151, 35152, 35159, 35160, 35162, 35165, 35170, 35177, 35180, 35183, 35185, 35186, 35240, 35286

INTERNAL COMBUSTION ENGINES
34899, 34904, 34907, 34909, 34910, 34911, 34913, 34916, 34931, 34943, 34960, 34970, 35006, 35011, 35012, 35014, 35034, 35036, 35043, 35045, 35058, 35061, 35144, 35390

INVERSION
35227, 35243

IODINE COMPOUNDS
35249

IONIZATION
35031, 35268, 35303

IONS
35065, 35132, 35264, 35272

IRON
34927, 34932, 34937, 34942, 34972, 34975, 34982, 35026, 35062, 35102, 35108, 35375, 35376, 35378, 35385

IRON COMPOUNDS
35132, 35181, 35193, 35197, 35264, 35269, 35313, 35315, 35372

IRON OXIDES
35026, 35334

ISOTOPES
35196, 35213, 35230, 35233, 35260, 35309

ITALY
34916, 34929, 35062, 35151, 35220, 35255, 35294, 35313

J

JAPAN
34920, 34965, 34981, 34984, 35030, 35044, 35063, 35068, 35071, 35072, 35073, 35084, 35146, 35154, 35155, 35163, 35166, 35185, 35186, 35193, 35197, 35198, 35217, 35218, 35219, 35222, 35229, 35263, 35278, 35312, 35328, 35376, 35402, 35408, 35422

JET AIRCRAFT
35035, 35240, 35248, 35249

K

KANAGAWA PREFECTURE
35193, 35376

KEROSENE
35055

KILNS
34955, 34966, 34988, 35037, 35064, 35076, 35112, 35385, 35412

KRAFT PULPING
34896, 34934, 34938, 34948, 34972, 34984, 34988, 35085, 35165, 35385

L

LABORATORY ANIMALS
35329, 35330, 35331, 35334, 35336, 35339, 35343, 35345, 35349, 35351, 35355, 35358, 35361

LABORATORY FACILITIES
34991

LAKES
35208, 35211, 35225, 35370

LAND USE
34974, 35001, 35223, 35418

LASERS
35165, 35252

LAUNDERING (COAL)
34932, 35006, 35096

LEAD
34937, 35385

LEAD COMPOUNDS
34909, 34996, 34999, 35111, 35126, 35132, 35150, 35190, 35191, 35192, 35193, 35196, 35197, 35249, 35350, 35354, 35355, 35357, 35371, 35372, 35388

LEAD PEROXIDE CANDLE
35135

LEAVES
35367

LEGISLATION
35237, 35382, 35396, 35401, 35410, 35412, 35414, 35420, 35421, 35428, 35436

LIDAR
35146, 35228

LIGHT SCATTERING
34900, 34920, 35129, 35130, 35169, 35176, 35185, 35240, 35248, 35256, 35265, 35275, 35306

LIME
34966, 34988, 35064, 35076, 35112, 35385, 35412

LIMESTONE
34966, 34969, 34983, 34994, 35079

LITHIUM COMPOUNDS
35295

LITIGATION
35417

LOCAL GOVERNMENTS
35399

LONDON
34917, 35237

LOS ANGELES
35121, 35192, 35333, 35416, 35419, 35435

LOWER ATMOSPHERE
35167, 35209, 35213, 35214, 35227, 35229, 35231, 35233, 35235, 35243, 35247, 35248, 35252

LUNG CANCER
35334, 35351

LUNG CLEARANCE
35334

LUNGS
35329, 35339, 35343, 35348, 35353, 35358, 35361

M

MAGNESIUM COMPOUNDS
34990, 35082, 35197, 35326

MAGNETIC PROPERTIES
35125

MAGNETOHYDRODYNAMICS (MHD)
34953, 34974, 35381

MAINTENANCE
34961, 34976, 35004, 35022, 35029, 35030, 35032, 35034, 35154

MANGANESE
35366

MANGANESE COMPOUNDS
35193, 35197, 35264

MANUAL
35153

MAPPING
34952, 35203, 35372

MARYLAND
35335, 35406

MASS SPECTROMETRY
35128, 35145, 35162, 35164, 35180

MASS TRANSPORTATION
34921, 34928, 34992, 35001, 35205, 35406, 35418

MATHEMATICAL ANALYSES
34900, 34901, 34904, 34905, 34953, 34958, 34968, 35047, 35053, 35140, 35145, 35158, 35165, 35176, 35214, 35223, 35226, 35233, 35235, 35239, 35242, 35246, 35256, 35262, 35276, 35285, 35286, 35290, 35292, 35294, 35297, 35298, 35301, 35302, 35305, 35306, 35312, 35404, 35416

MATHEMATICAL MODELING
34900, 34905, 34958, 35223, 35233, 35235, 35239, 35242, 35256, 35262, 35285, 35294, 35297, 35301, 35416

MAXIMUM ALLOWABLE CONCENTRATION
35393

MEETINGS
35438

MEMBRANE FILTERS
34920, 35156, 35181, 35251

MERCAPTANS
35155

MERCURY
34912, 35264

MERCURY COMPOUNDS
34951, 35148, 35170, 35183, 35188, 35372, 35384, 35392

METABOLISM
35342, 35367

METAL COMPOUNDS
34896, 34909, 34925, 34927, 34937, 34939, 34946, 34947, 34951, 34965, 34966, 34969, 34990, 34996, 34999, 35036, 35075, 35076, 35082, 35092, 35111, 35112, 35118, 35126, 35132, 35148, 35150, 35161, 35167, 35170, 35175, 35181, 35183, 35188, 35190, 35191, 35192, 35193, 35196, 35197, 35249, 35264, 35269, 35284, 35295, 35299, 35313, 35315,

35316, 35322, 35326, 35329, 35330, 35343, 35347, 35350, 35352, 35354, 35355, 35356, 35357, 35371, 35372, 35384, 35388, 35392

METAL FABRICATING AND FINISHING
34931, 34932, 34941, 34957, 34971, 34972, 34987, 35095, 35347, 35384, 35385

METAL POISONING
35347, 35350, 35354, 35356, 35357

METALS
34903, 34912, 34927, 34932, 34937, 34941, 34942, 34947, 34952, 34972, 34975, 34982, 34987, 35026, 35049, 35050, 35053, 35054, 35062, 35089, 35095, 35102, 35108, 35109, 35111, 35117, 35366, 35375, 35376, 35378, 35384, 35385

METEOROLOGY
34966, 35132, 35161, 35169, 35176, 35194, 35196, 35197, 35198, 35200, 35203, 35206, 35208, 35215, 35216, 35218, 35219, 35220, 35221, 35222, 35224, 35225, 35227, 35228, 35229, 35234, 35235, 35236, 35237, 35238, 35239, 35240, 35241, 35242, 35243, 35244, 35245, 35246, 35247, 35248, 35249, 35250, 35251, 35252, 35253, 35254, 35255, 35257, 35259, 35260, 35261, 35262, 35270, 35297, 35319, 35338, 35360, 35363, 35375, 35376, 35378, 35408, 35414, 35433

METHANES
34901, 34905, 34907, 35134, 35155, 35213, 35267, 35273, 35289, 35432

MICE
35339, 35358

MICHIGAN
35225

MICROMETEOROLOGY
35224, 35236, 35238, 35259

MICROORGANISMS
35049, 35059, 35231, 35289, 35302, 35348, 35359, 35366, 35373

MICROSCOPY
35376

MIDDLE ATMOSPHERE
35119, 35167, 35209, 35213, 35214, 35227, 35231, 35233, 35235

MINERAL PROCESSING
34912, 34976, 34985, 35037, 35049, 35064, 35069, 35108, 35160, 35384, 35385, 35412, 35417

MINING
34976, 34985, 35049, 35160, 35412

MINNESOTA
35429

MISSILES AND ROCKETS
35184, 35373

MISTS
35097, 35106

MOLYBDENUM COMPOUNDS
35330

MONITORING
35003, 35029, 35122, 35131, 35134, 35136, 35137, 35159, 35162, 35163, 35165, 35166, 35167, 35173, 35184, 35201, 35219, 35220, 35227, 35228, 35305, 35405, 35408, 35409

MONTHLY
35202

MORBIDITY
35332, 35333, 35335, 35366, 35411

MORTALITY
35297, 35330, 35332, 35335, 35343, 35345, 35364, 35366, 35411

MOUNTAINS
35215

MULTIPLE CHAMBER INCINERATORS
34977

MUTATIONS
35352

N

NATIONAL AIR SAMPLING NETWORK (NASN)
35199

NATURAL GAS
34903, 34908, 34919, 34923, 34940, 34960, 34979, 34986, 34999, 35040, 35051, 35094, 35279, 35285

NERVOUS SYSTEM
35350, 35427

NETHERLANDS
35096, 35103, 35236

NEUTRON ACTIVATION ANALYSIS
35126, 35142, 35157, 35164

NEW MEXICO
35369, 35404

NEW YORK CITY
35205

NEW YORK STATE
35200, 35205, 35417

NICKEL
34937

NICKEL COMPOUNDS
35193, 35197, 35264, 35284, 35329, 35343, 35372

NITRATES
34907, 35119, 35132, 35167, 35193, 35194, 35257, 35295, 35337, 35353, 35358

NITRIC ACID
34932, 35040, 35089, 35090, 35091, 35289, 35385

NITRIC OXIDE (NO)
34904, 34909, 34910, 34932, 34945, 34952, 34958, 34961, 34965, 35005, 35066, 35089, 35100, 35101, 35115, 35116, 35120, 35125, 35136, 35141, 35143, 35144, 35145, 35154, 35163, 35166, 35167, 35205, 35264, 35267, 35278, 35281, 35286, 35289, 35298, 35308, 35310, 35313, 35317, 35318

NITRILES
35305

NITRITES
35132, 35257, 35337, 35352

NITROGEN
34945, 34950, 34966, 35112, 35211, 35257, 35270, 35272, 35293, 35299, 35310

NITROGEN DIOXIDE (NO2)
34953, 34958, 34966, 35005, 35089, 35093, 35107, 35124, 35136, 35144, 35153, 35154, 35163, 35166, 35167, 35201, 35205, 35267, 35289, 35319, 35355, 35377, 35391

NITROGEN OXIDES
34904, 34905, 34909, 34910, 34922, 34924, 34925, 34932, 34935, 34943, 34945, 34952, 34953, 34954, 34958, 34960, 34961, 34962, 34965, 34966, 34971, 34983, 34989, 34997, 35005, 35040, 35045, 35055, 35061, 35066, 35087, 35088, 35089, 35090, 35091, 35093, 35094, 35100, 35101, 35107, 35115, 35116, 35120, 35122, 35124, 35125, 35136, 35141, 35143, 35144, 35145, 35153, 35154, 35161, 35163, 35166, 35167, 35201, 35205, 35221, 35229, 35264, 35267, 35268, 35278, 35281, 35286, 35289, 35298, 35308, 35310, 35313, 35317, 35318, 35319, 35324, 35325, 35331, 35355, 35361, 35376, 35377, 35385, 35391, 35408, 35414, 35432

NITROUS OXIDE (N2O)
35268, 35289, 35298, 35324, 35325, 35331, 35361, 35432

NON-URBAN AREAS
34906, 34917, 34930, 35192, 35199, 35200, 35202, 35204, 35206, 35207, 35210, 35220, 35228, 35236, 35237, 35238, 35259, 35328

NORTH CAROLINA
35395

NORWAY
35354, 35366, 35372

NOSTRILS
35365

NUCLEAR POWER PLANTS
34908, 34922, 34924, 34939, 34963, 34974, 35260

NUCLEAR POWER SOURCES
34994

NUCLEATION
35222, 35244, 35249, 35250, 35251, 35270, 35280, 35288

O

OCEANS
35207, 35211, 35216, 35222, 35223, 35230, 35234, 35235, 35243, 35275

OCTANES
34996, 35388

ODOR COUNTERACTION
34973, 34984, 34991, 35002, 35003, 35112

ODORIMETRY
35138, 35174

ODORS
34897, 34904, 34907, 34909, 34925, 34934, 34938, 34984, 34988, 34991, 35002, 35003, 35061, 35085, 35105, 35112, 35138, 35155, 35417

OIL BURNERS
34950

OLEFINS
34907, 34996, 35087, 35149, 35163, 35267, 35274, 35283, 35287, 35296, 35304, 35309, 35325, 35352

OPEN BURNING
34930, 35106, 35385

OPERATING VARIABLES
34896, 34899, 34904, 34907, 34909, 34913, 34929, 34934, 34961, 34984, 35003, 35005, 35029, 35038, 35056, 35062, 35071, 35101, 35286, 35312, 35316, 35381, 35387

OREGON
34935, 35257

ORGANIC NITROGEN COMPOUNDS
34906, 35155, 35161, 35257, 35352, 35377

ORGANIC PHOSPHORUS COMPOUNDS
35299

ORGANIC SULFUR COMPOUNDS
34934, 34938, 35105, 35155, 35299

ORGANIC WASTES
34906, 34991, 35112, 35417

ORGANOMETALLICS
35299

OXIDANTS
34943, 35122, 35166, 35219, 35229, 35333, 35355, 35376, 35391, 35408, 35414

OXIDATION
34912, 34919, 34952, 35005, 35278, 35279, 35287, 35298, 35303, 35316, 35318

OXYGEN
34930, 34937, 35141, 35163, 35270, 35272, 35273, 35274, 35278, 35279, 35287, 35289, 35293, 35296, 35298, 35299, 35303, 35308, 35310, 35316, 35339

OZONE
35122, 35136, 35149, 35161, 35167, 35175, 35209, 35214, 35224, 35227, 35246, 35253, 35264, 35265, 35267, 35303, 35309, 35319, 35355, 35391, 35414, 35432

P

PACKED TOWERS
35097, 35106

PAINT MANUFACTURING
34973

PAPER MANUFACTURING
34972, 35082

PARIS
35128

PARTICLE COUNTERS
34920, 35130, 35137, 35185, 35244, 35288

PARTICLE GROWTH
35249, 35251, 35270, 35271, 35280, 35288

PARTICLE SHAPE
34913, 35271

PARTICLE SIZE
34900, 34902, 34913, 34920, 35010, 35119, 35123, 35129, 35130, 35132, 35140, 35147, 35159, 35160, 35176, 35179, 35185, 35194, 35228, 35271, 35280, 35288, 35290, 35295, 35302, 35334, 35386

PARTICULATE SAMPLING
34913, 34920, 34976, 35122, 35132, 35137, 35139, 35142, 35152, 35160, 35178, 35194, 35204, 35346

PATHOLOGICAL TECHNIQUES
35351, 35358, 35361

PENELEC (CONTACT PROCESS)
35109, 35111

PENNSYLVANIA
35108, 35201, 35421, 35424

PENTENES
35283

PERMITS
35395, 35424

PEROXIDES
35267, 35272

PEROXYACETYL NITRATE
34907, 35353, 35358

PEROXYACYL NITRATES
34907, 35353, 35358

PERSONNEL
35174, 35205

PERSONNEL QUALIFICATIONS
35399

PESTICIDES
35010, 35291, 35352

PETER SPENCE PROCESS (CLAUS)
35039, 35078

PETROLEUM DISTRIBUTION
34973, 35115, 35383, 35385, 35406

PETROLEUM PRODUCTION
34923, 34971, 34979, 35285, 35385

PETROLEUM REFINING
34971, 34972, 34973, 35284

PH
35047, 35342

PHILADELPHIA
35201

PHOSPHORIC ACID
35042, 35112

PHOSPHORUS COMPOUNDS
35039, 35042, 35112, 35161, 35264, 35299, 35388

PHOTOCHEMICAL REACTIONS
34907, 34943, 34996, 35221, 35229, 35267, 35270, 35272, 35273, 35274, 35283, 35289, 35291, 35303, 35307, 35319, 35341

PHOTOELECTRIC PHENOMENA
35121, 35130, 35268, 35273, 35274

PHOTOGRAPHIC METHODS
35129, 35184

PHOTOIONIZATION
35303

PHOTOLYSIS
34943, 35267, 35270, 35273, 35291, 35307

PHOTOMETRIC METHODS
35130, 35134, 35151, 35163, 35172, 35176, 35179, 35183, 35185, 35188, 35228, 35432

PHOTOOXIDATION
35274

PHOTOSYNTHESIS
34930, 35223, 35230, 35367

PHYTOTOXICANTS
35291, 35352

PILOT PLANTS
34912, 34945, 34948, 34953, 35062

PITTSBURGH
35421

PLANNING AND ZONING
34974, 35001, 35195, 35223, 35418

PLANT DAMAGE
35184, 35201, 35203, 35228, 35369, 35373, 35374

PLANT GROWTH
34930, 35223, 35230, 35367, 35370

PLANT INDICATORS
35368, 35371

PLATINUM
35089, 35117

PLUME BEHAVIOR
35215, 35226, 35236, 35239, 35245, 35260, 35261, 35434

PLUTONIUM COMPOUNDS
35190, 35191, 35196, 35329

PNEUMOCONIOSIS
35344, 35346

PNEUMONIA
35358, 35366

POINT SOURCES
35239

POLAROGRAPHIC METHODS
35150

POLYMERIZATION
35283

POLYNUCLEAR COMPOUNDS
34902, 35192, 35199, 35304, 35334

POTASSIUM COMPOUNDS
35112

POTENTIOMETRIC METHODS
35166, 35171, 35187

POULTRY
34991, 35112

POWER SOURCES
34899, 34904, 34907, 34908, 34909, 34910, 34911, 34913, 34916, 34929, 34931, 34943, 34958, 34960, 34970, 34974, 34992, 34994, 34999, 35006, 35011, 35012, 35014, 35034, 35036, 35043, 35045, 35055, 35058, 35061, 35066, 35074, 35144, 35364, 35390, 35397

PRECIPITATION
35169, 35216, 35218, 35220, 35236, 35238, 35249, 35251, 35253, 35257, 35259, 35319

PRESSURE (ATMOSPHERIC)
35219

PRIMARY METALLURGICAL PROCESSING
34903, 34927, 34931, 34932, 34937, 34941, 34942, 34947, 34957, 34971, 34972, 34973, 34975, 34982, 35026, 35049, 35050, 35053, 35054, 35062, 35102, 35108, 35109, 35111, 35118, 35249, 35366, 35385

PRINTING
34901

PROCESS MODIFICATION
34903, 34918, 34923, 34924, 34947, 34948, 34950, 34953, 34956, 34961, 34962, 34964, 34971, 34972, 34973, 34975, 34977, 34982, 34993, 35003, 35006, 35010, 35025, 35048, 35054, 35060, 35095, 35103, 35105, 35111, 35381, 35413

PROPANES
34907, 34998, 35163

PROPENES
35283

PROTECTIVE MASKS
34976

PROTEINS
35341

PUBLIC AFFAIRS
35400, 35405, 35418, 35420, 35421, 35439

PUBLIC INFORMATION
35400, 35405, 35439

PULMONARY FUNCTION
35344, 35362

PYRENES
34902, 35199, 35334

PYROLYSIS
34938, 34993

Q

QUENCHING
34907

QUESTIONNAIRES
35365

R

RADIATION MEASURING SYSTEMS
35125, 35158, 35165, 35240

RADIOACTIVE RADIATION
34922, 34924, 35121, 35126, 35132, 35133, 35137, 35156, 35190, 35191, 35226, 35227, 35255, 35260, 35344, 35357

RADIOACTIVE TRACERS
35227

RADIOLOGICAL HEALTH
35344

RAIN
35218, 35257

RAPPING
35022

RATS
35329, 35330, 35331, 35339, 35345

REACTION KINETICS
34905, 34907, 34910, 34937, 34945, 34946, 34965, 34966, 35161, 35272, 35273, 35274, 35280, 35281, 35282, 35291, 35293, 35298, 35301, 35303, 35305, 35308, 35310, 35316, 35317, 35318, 35319, 35377

REACTION MECHANISMS
34899, 34905, 34907, 34910, 34937, 34943, 34945, 34946, 35053, 35107, 35161, 35221, 35231, 35264, 35272, 35274, 35278, 35279, 35281, 35283, 35291, 35298, 35305, 35308, 35310, 35311, 35314, 35315, 35316, 35317, 35318, 35319, 35322, 35327, 35353, 35377

REACTORS (NUCLEAR)
34939, 34963, 35260

RECOMBINATION
34919

RECORDING METHODS
35129, 35184

RECREATION AREAS
35202, 35204

REDUCTION
34946, 34952, 34971, 35040, 35050, 35089, 35090, 35091, 35093, 35094, 35098, 35101, 35175, 35211, 35263, 35278, 35308, 35364

REFRACTIVE INDEX
34980, 35130, 35179, 35256

REGIONAL GOVERNMENTS
35413, 35423

REGULATIONS
35154, 35380, 35382, 35388, 35390, 35397, 35401, 35404, 35406, 35407, 35421, 35424, 35428, 35429, 35430, 35436

REINLUFT PROCESS (ADSORPTION)
35076, 35083

REPRODUCTION
35328, 35331

RESEARCH METHODOLOGIES
35329, 35409

RESEARCH PROGRAMS
34962, 35223, 35238, 35399, 35409, 35422, 35430

RESIDENTIAL AREAS
35193, 35210, 35429

RESIDUAL OILS
35088

RESPIRATORY DISEASES
35333, 35336, 35338, 35340, 35342, 35344, 35346, 35348, 35358, 35359, 35363, 35364, 35365, 35366

RESPIRATORY SYSTEM
35329, 35338, 35339, 35343, 35345, 35348, 35353, 35358, 35361, 35365

RETENTION
35334, 35343, 35354, 35357, 35367, 35372, 35374, 35375

RIVERS
35218, 35238

RUBBER
34977

RUBBER MANUFACTURING
34973

S

SAFETY EQUIPMENT
35412

SAMPLERS
34900, 34920, 35132, 35142, 35154, 35155, 35156, 35159, 35178, 35181, 35251, 35302, 35379

SAN FRANCISCO
35121, 35423

SCANDINAVIA
34896, 34934, 35007, 35009, 35046, 35082, 35209, 35214, 35348, 35354, 35360, 35363, 35366, 35372

SCATTERING (ATMOSPHERIC)
35224, 35240, 35243, 35248, 35252, 35256, 35275

SCRUBBERS
34918, 34951, 34954, 34962, 34964, 34969, 34971, 34975, 34981, 34985, 34988, 34990, 35007, 35013, 35019, 35023, 35041, 35047, 35049, 35051, 35056, 35057, 35059, 35063, 35069, 35076, 35078, 35085, 35086, 35096, 35097, 35098, 35099, 35106, 35197, 35276, 35386, 35387

SEA BREEZE
35229

SEDIMENTATION
35092, 35302

SETTLING PARTICLES
34920, 34922, 34931, 34949, 34975, 34976, 34982, 34985, 35007, 35022, 35026, 35029, 35030, 35032, 35034, 35037, 35046, 35047, 35048, 35056, 35057, 35059, 35064, 35068, 35069, 35071, 35072, 35108, 35111, 35114, 35160, 35166, 35169, 35195, 35197, 35202, 35226, 35276, 35290, 35302, 35304, 35334, 35346, 35370, 35374, 35376, 35386, 35387, 35394, 35408, 35412, 35417

SEWAGE
34972, 34973

SEWAGE TREATMENT
34972, 34973

SHIPS
35108

SILICATES
35088, 35132, 35311, 35379

SILICON COMPOUNDS
35088, 35132, 35311, 35379

SILICON DIOXIDE
35077, 35318, 35321

SILVER COMPOUNDS
35175

SIMULATION
35198, 35217, 35262, 35267, 35416

SINTERING
34941, 34944, 35111

SINUSES
35365

SKIN
35346, 35356

SMOG
34907, 35092, 35219, 35229, 35267, 35333, 35376, 35408, 35433

SMOKE SHADE
34980, 34920, 35057, 35061, 35140, 35237

SMOKEMETERS
34980, 35140

SMOKES
34917, 34931, 34961, 35019, 35036, 35061, 35062, 35108, 35141, 35237, 35258, 35366, 35408, 35421, 35424

SMOKING
34920, 35335

SNOW
35218

SOCIO-ECONOMIC FACTORS
34911, 34921, 34996, 35332, 35382, 35383, 35384, 35385, 35411, 35418, 35425, 35431

SODIUM COMPOUNDS
34896, 34946, 34947, 35352

SOILS
34965, 34966, 35171, 35184, 35216, 35218, 35234, 35235, 35289

SOLAR RADIATION
35169, 35219, 35221, 35224, 35228, 35240, 35246, 35248, 35256, 35259, 35267, 35275, 35291

SOLID WASTE DISPOSAL
34906, 34918, 34935, 34972, 34973, 34977, 34982, 34991, 35108, 35112, 35385, 35417

SOLVENT REFINING (LOW ASH)
35364

SOLVENTS
34901, 34973, 35062, 35406

SOOT
35057, 35226, 35304

SOURCE SAMPLING
35143, 35162

SO2 REMOVAL (COMBUSTION PRODUCTS)
34922, 34941, 34942, 34951, 34954, 34957, 34962, 34969, 34972, 34981, 34983, 34984, 34988, 34990, 35015, 35016, 35017, 35020, 35021, 35039, 35042, 35044, 35049, 35050, 35051, 35052, 35053, 35054, 35063, 35065, 35073, 35075, 35076, 35077, 35078, 35079, 35080, 35081, 35083, 35084, 35095, 35098, 35102, 35106, 35109, 35111, 35113, 35117, 35118, 35311, 35314, 35316, 35324, 35326, 35364, 35381

SPARK IGNITION ENGINES
34899, 34907, 34909, 34910, 34911, 34913, 34916, 34943, 35014, 35058

SPARK TIMING
34907, 34960, 34970, 35014

SPECTROMETRY
34943, 35121, 35124, 35128, 35131, 35132, 35134, 35143, 35144, 35145, 35151, 35156, 35158, 35162, 35164, 35166, 35180, 35217, 35268, 35283, 35313, 35432

SPECTROPHOTOMETRY
34907, 34951, 35127, 35135, 35148, 35163, 35164, 35170, 35432

SPERMATOZOA
35350

SPORES
35302

SPRAY TOWERS
34954, 34964, 34981, 35007, 35099

SPRAYS
34976

STABILITY (ATMOSPHERIC)
35194, 35215, 35219, 35225, 35227, 35228, 35243, 35255, 35259, 35261, 35276, 35360

STACK GASES
34897, 34901, 34912, 34931, 34937, 34938, 34941, 34942, 34945, 34946, 34951, 34953, 34954, 34955, 34957, 34962, 34964, 34968, 34969, 34971, 34972, 34975, 34977, 34981, 34982, 34983, 34984, 34988, 34990, 34994, 35013, 35015, 35016, 35017, 35019, 35020, 35021, 35028, 35040, 35041, 35042, 35044, 35050, 35051, 35052, 35053, 35057, 35059, 35060, 35062, 35063, 35065, 35072, 35073, 35075, 35076, 35077, 35078, 35079, 35080, 35081, 35083, 35084, 35085, 35088, 35089, 35090, 35091, 35093, 35094, 35097, 35098, 35099, 35100, 35102, 35104, 35105, 35106, 35107, 35109, 35110, 35113, 35117, 35118, 35122, 35131, 35140, 35143, 35154, 35162, 35164, 35177, 35180, 35189, 35239, 35260, 35261, 35321, 35346, 35364, 35381, 35404, 35424, 35438

STACK SAMPLING
35143, 35162

STACKS
34972, 34994, 35019, 35215, 35239, 35261, 35364, 35434, 35438

STAGNATION
35194, 35219

STATE GOVERNMENTS
35389, 35395, 35396, 35399, 35400, 35406, 35410, 35429

STATISTICAL ANALYSES
34900, 34917, 35142, 35198, 35221, 35297, 35332

STEAM
34919, 35103

STEAM ENGINES
34929, 34999

STEAM PLANTS
34908, 34922, 34924, 34936, 34974, 35060, 35131, 35137, 35164, 35381

STEEL
34927, 34972, 34975, 34982, 35026, 35062, 35102, 35108, 35378, 35385

STONE
35412

STORAGE BATTERIES
35397

STRATIFIED CHARGE ENGINES
34911

STREETS
35305, 35357

STRONTIUM COMPOUNDS
35190, 35191

SUBWAYS
35205

SULFATES
34898, 34946, 35044, 35119, 35121, 35132, 35167, 35193, 35194, 35216, 35221, 35316, 35405

SULFIDES
34937, 34938, 34946, 34948, 34984, 34986, 35015, 35020, 35021, 35039, 35041, 35050, 35051, 35087, 35102, 35118, 35121, 35122, 35154, 35155, 35166, 35211, 35216, 35268, 35282, 35283, 35296, 35315, 35321, 35322, 35432

SULFITES
35121, 35330

SULFUR COMPOUNDS
34896, 34898, 34937, 34938, 34946, 34948, 34957, 34984, 34986, 34987, 35015, 35016, 35017, 35020, 35021, 35039, 35041, 35044, 35050, 35051, 35054, 35078, 35081, 35083, 35087, 35095, 35102, 35105, 35110, 35118, 35119, 35121, 35122, 35132, 35154, 35155, 35166, 35167, 35193, 35194, 35195, 35211, 35216, 35221, 35264, 35268, 35272, 35282, 35283, 35293, 35296, 35299, 35315, 35316, 35321, 35322, 35327, 35330, 35405, 35432

SULFUR DIOXIDE
34898, 34917, 34922, 34935, 34937, 34941, 34942, 34946, 34953, 34957, 34969, 34981, 34983, 34994, 35039, 35042, 35044, 35045, 35055, 35061, 35075, 35083, 35098, 35109, 35113, 35121, 35122, 35131, 35135, 35136, 35143, 35146, 35154, 35156, 35161, 35166, 35168, 35175, 35182, 35187, 35195, 35198, 35201, 35205, 35206, 35207, 35208, 35216, 35221, 35258, 35264, 35266, 35270, 35272, 35273, 35279, 35311, 35314, 35315, 35316, 35322, 35323, 35324, 35325, 35326, 35327, 35328, 35330, 35355, 35364, 35368, 35369, 35374, 35375, 35378, 35379, 35391, 35400, 35404, 35432, 35434, 35438

SULFUR OXIDES
34898, 34904, 34909, 34917, 34922, 34924, 34925, 34935, 34937, 34941, 34942, 34946, 34953, 34957, 34960, 34972, 34981, 34983, 34994, 35039, 35042, 35044, 35045, 35052, 35055, 35061, 35075, 35083, 35098, 35109, 35110, 35113, 35121, 35122, 35131, 35135, 35136, 35143, 35146, 35154, 35156, 35161, 35166, 35168, 35175, 35182, 35187, 35189, 35195, 35198, 35201, 35205, 35206, 35207, 35208, 35216, 35221, 35258, 35264, 35266, 35270, 35272, 35273, 35279, 35311, 35314, 35315, 35316, 35322, 35323, 35324, 35325, 35326, 35327, 35328, 35330, 35355, 35364, 35368, 35369, 35374, 35375, 35376, 35378, 35379, 35385, 35391, 35400, 35404, 35408, 35432, 35434, 35438

SULFUR OXIDES CONTROL
34919, 34922, 34932, 34941, 34942, 34951, 34954, 34956, 34957, 34962, 34969, 34972, 34974, 34981, 34983, 34984, 34986, 34988, 34990, 34994, 35008, 35015, 35016, 35017, 35020, 35021, 35038, 35039, 35042, 35044, 35049, 35050, 35051, 35052, 35053, 35054, 35063, 35065, 35070, 35073, 35075, 35076, 35077, 35078, 35079, 35080, 35081, 35083, 35084, 35086, 35095, 35096, 35098, 35102, 35106, 35109, 35110, 35111, 35113, 35115, 35117, 35118, 35311, 35314, 35316, 35324, 35326, 35364, 35381

SULFUR TRIOXIDE
34937, 35044, 35052, 35055, 35121, 35189, 35279

SULFURIC ACID
34898, 34957, 34972, 35021, 35042, 35044, 35049, 35075, 35080, 35081, 35084, 35097, 35106, 35109, 35119, 35270, 35280, 35385

SUPERSATURATION
35251, 35288

SURFACE COATING OPERATIONS
34973

SURFACE PROPERTIES
35208, 35325

SURFACTANTS
35047

SURVEY METHODS
35166, 35203, 35204, 35238, 35346, 35402, 35405, 35408, 35419

SUSPENDED PARTICULATES
34898, 34907, 34917, 34931, 34944, 34947, 34961, 34982, 35007, 35019, 35036, 35061, 35062, 35079, 35092, 35097, 35103, 35106, 35108, 35111, 35129, 35141, 35176, 35193, 35194, 35195, 35197, 35199, 35219, 35229, 35237, 35258, 35267, 35280, 35288, 35333, 35366, 35376, 35405, 35408, 35421, 35424, 35433

SWEDEN
34896, 34934, 35007, 35009, 35046, 35082, 35209, 35214, 35360, 35372

SYNERGISM
35330

T

TAXATION
34994, 35380

TEMPERATURE
34896, 34899, 34952, 34991, 35068, 35168, 35243, 35278, 35282, 35288, 35298, 35304, 35308, 35312, 35317, 35320

TEMPERATURE (ATMOSPHERIC)
35169, 35206, 35219, 35220, 35221, 35224, 35227, 35228, 35234, 35235, 35243, 35246, 35251, 35259, 35408

TEMPERATURE GRADIENT
35259, 35276

TEST ENGINES
34929, 35390

TETRAETHYL LEAD
35350

TEXTILE MANUFACTURING
34973

TEXTILES
34920

THERMAL RADIATION
34922, 34924, 34963, 34974, 34993, 34995, 35238, 35245, 35301, 35427

THERMODYNAMICS
34899, 34904, 34907, 34910, 34919, 34937, 34945, 35003, 35161, 35221, 35279, 35282, 35285, 35299, 35305, 35312, 35317, 35320, 35322

THRESHOLDS
35174, 35330, 35346, 35349

THUNDERSTORMS
[illegible], 35319

TIMED FUEL INJECTION
35061

TIRES
34977

TISSUE CULTURES
35348, 35359

TISSUES
35329

TOKYO
35197, 35229

TOLUENES
35163

TOPOGRAPHIC INTERACTIONS
35198, 35206, 35215, 35220, 35222, 35226, 35239, 35241, 35261, 35262, 35414

TOXIC TOLERANCES
35336, 35339, 35340, 35361, 35364

TOXICITY
34925, 35223, 35291, 35330, 35331, 35340, 35342, 35345, 35346, 35349, 35350, 35353, 35354, 35355, 35356, 35357, 35358, 35360, 35361, 35363, 35364, 35368, 35373, 35393, 35426, 35427, 35437

TRACE ANALYSES
34982, 35126, 35133, 35142, 35150, 35181

TRACERS
35167, 35207, 35215, 35217, 35227, 35252, 35295

TRACHEA
35358, 35365

TRAINS
35108, 35430

TRANS-2-BUTENE
35267

TRANSMISSOMETERS
34988

TRANSPORT
35194, 35209, 35211, 35212, 35213, 35214, 35215, 35216, 35223, 35225, 35227, 35230, 35231, 35233, 35234, 35235, 35236, 35250, 35271

TRAPPING (SAMPLING)
34982, 35128, 35135

TREES
35184, 35374

TRUCKS
34916, 35385, 35388, 35390, 35406, 35430

TUMORS
35351

TURBULENCE (ATMOSPHERIC)
34968, 35206, 35212, 35227, 35245, 35252

TVA
35164

U

ULTRASONICS
35139

ULTRAVIOLET RADIATION
35125, 35229, 35236, 35259, 35270, 35283, 35289, 35291

ULTRAVIOLET SPECTROMETRY
35131, 35144

UNITED STATES
34927, 35199, 35301, 35410, 35422

UPPER ATMOSPHERE
35161

URANIUM COMPOUNDS
34939

URBAN AREAS
34917, 34926, 34977, 35119, 35121, 35128, 35192, 35193, 35195, 35198, 35200, 35201, 35202, 35205, 35210, 35220, 35224, 35227, 35228, 35236, 35237, 35242, 35243, 35247, 35250, 35259, 35262, 35297, 35328, 35333, 35335, 35337, 35366, 35368, 35374, 35376, 35384, 35408, 35411, 35419, 35423, 35425, 35429

URINALYSIS
35354

USSR
34946, 34969, 35003, 35036, 35065, 35080, 35100, 35120, 35138, 35176, 35236, 35256, 35277, 35279, 35286, 35313, 35347, 35350

V

VANADIUM
34927

VANADIUM COMPOUNDS
34927, 35193, 35197

VAPOR PRESSURE
34929, 35169, 35285, 35314

VAPOR RECOVERY SYSTEMS
34973, 34997

VAPORS
34919, 35103, 35152, 35249, 35270, 35276, 35288, 35289, 35346

VENTILATION
34920, 34976, 34995

VENTILATION (PULMONARY)
35336

VENTURI SCRUBBERS
34964, 34975, 34985, 34988, 35019, 35059, 35387

VIRGINIA
35406

VISIBILITY
35237

VISIBLE RADIATION
35236

VOLATILITY
34986, 34996, 35103, 35152, 35266

VOLCANOES
34998

VOLTAGE
35168

W

WASHINGTON (STATE)
35406

WASHINGTON D C
35150

WASHOUT
35216, 35218, 35236

WATER
34976, 35047, 35053, 35063, 35107, 35132, 35231, 35268, 35270, 35280, 35282, 35289, 35311, 35326, 35432

WATER POLLUTION
35099, 35166, 35225, 35431, 35436

WEATHER MODIFICATION
35229, 35230, 35233, 35234, 35235, 35236, 35237, 35238, 35240, 35242, 35244, 35245, 35246, 35248, 35249, 35250, 35251

WEST AND GAEKE METHOD
35168, 35182

WEST VIRGINIA
35396, 35409

WET CYCLONES
35066, 35096, 35197

WETTING
34976, 35047

WIND TUNNELS
35217

WINDS
35161, 35194, 35197, 35200, 35203, 35206, 35208, 35215, 35219, 35220, 35225, 35229, 35230, 35241, 35247, 35252, 35254, 35255, 35259, 35261, 35262, 35408

WOOD
35019

X

X-RAYS
35121, 35132, 35133, 35156, 35344

Y

YOKKAICHI
35328

YOKOHAMA
35193

Z

ZINC
34937, 34941, 35095, 35111, 35375, 35385

ZINC COMPOUNDS
35111, 35132, 35197, 35347, 35372

AUTHOR INDEX

A

ABBOUD H I *35004
ABERBACH R J *34936
ABIDOVA M G *35284
ACHTEN G *35356
ADAMS C N *35265
ADEE R R *35329
AKESSON N B 35010
AKLAND G G 35194
ALDRICH R H *35380
ALLGOOD R W *35109
ALLMAND A J *35321
ALLSUP J R 34960
ALTSHULLER A P *35167
ANDERSEN H C *35087, *35089, *35090, 35091
ANDERSON T H *35048
ANDERSSON K 34934
ANTONINI F 35341
ATKINS D H F 35206
AYER F A 35384
AYERS L 35339

B

BACASTOW R *35230
BAKER H T *35104
BAKER R K 35266
BAKER R W *35318
BAKHANOVA R A *35130
BALDWIN J M *34951
BANGHAM D H *35324, *35325
BARBE C *35285
BARLTROP D *35357
BARNES H M JR *35131
BARNHART D H *34944
BARON S *34974
BARRER R M *35311
BARRETT C F 35261
BARTON H J 34940
BASOV V A 35292
BATE L C 35164
BAUM W H *35005
BAURER T 35310
BAZAN F 35133
BEALS G C *35049
BEAR F K 35112
BEL KOV V P 35286
BENSON H E 35098
BENSON S W *35299, 35300
BENTELE M *35006
BENTLEY D R *34952
BENVENUTI F *34916
BERG B *35007
BERGMAN P D 34953, *35381
BERGSTROM J G T 34934
BERKAU E E 34961
BERNSTEIN R 34903
BETTER J W *35417
BIENSTOCK D *34953, *35098, 35381
BIGG E K *35119
BISCHOF W *35209
BISWAS A K *35050
BLACK F M *35120
BLACK W E 35135
BLACKWELL N E III *35008
BLANDER M *35132
BLAYDEN L C *34947
BOHN H L 34965, 34966
BOHNENKAMP K *35378
BOLLEN W B 35257
BOMPANE G F 35151
BONAVENTURA C 35341
BONAVENTURA J 35341
BONNER N A *35133
BORCHERTS R H 34992
BORG A *34896
BORNEFALK J O *35009
BOUCHUNG A F 35274
BOWNE N E *35210
BOYLAN D R 35075
BRADY J D 34985
BRAZELL J H *35237
BRENCHLEY D L *35159
BRENNAN J A *35088
BRESLOW L *35365
BRETSZNAJDER S *35316
BRODNIEWICZ A *35202
BRONDYKE K J 34947
BRUNN L W 35098
BRUNORI M *35341
BRYAN R J 35192
BUDNIKOFF P P *34946
BUDZINSKI K *35254
BUEHLMANN A A 35344
BUENNING K *35051
BUESSER E *35344
BUNYARD F L *35385
BURCH D E *35134
BURKARDT L A 35295
BURKE M F *35266
BURKHARDT D B *35052
BURRAGE L J 35321
BURRIS L 35132
BURT F P 35324, 35325
BUSTERUD J A *35382
BUTLER B J *35010
BYRNE J *35383

C

CADLE J J 35049
CADLE R D *34898, 35167, *35231
CAGNETTI P *35255
CALDWELL J 35194
CALVERT J G *35267
CAMP D C 35133
CARDEN P *34975
CARDINALE A *35294
CARLSON G D *35135
CARLSON T A *35268
CARPENTER C P 35349
CARPENTER T E 35159
CARPENTIER S 34977
CARTER H V *34897
CAUGHEY S J 35206
CHAKRABORTY B B *35304
CHAMBLEE C P *35398
CHANG C K *35269
CHANGNON S A JR *35238
CHAPLIN R 35321
CHAPPELL G A *34954
CHEN C S 35257
CHEN W L *35086
CHEVALIER G 34977
CHILDERS E *35094
CHOJNOWSKI M 34949
CHRISTIAN C M 35371
CINQUEGRANE G J 35078
CLARK T M *34976
CLARKE G L 35358
COHEN H J *35330
COHN J G E *35091
COLE A B 35384
CONRAD G *34955
COOK N J *35262
CORBETT T H *35331
CORNELL R G 35331
COSBY W T *35387
COTA H M *35136
COURBON P *35160
COVER A E *34956
COX L A *34948
COX R A *35270
COY D W 34900
CRAIG D K 35343
CRAIG N L *35121
CRANDALL W A *34924
CRAXFORD S R *34917
CRIST J G 35005
CROCKER B B *35122
CRUICKSHANK F R 35299, *35300
CUNNINGHAM P T *35123, 35132
CUTLIP M B *35305

D

DAMS R 35142
DANA V *35124
DANIELS F 34945
DARLING E M JR *35232
DAVE J V *35306
DAVEY T R A *34957
DAVID M P 34901
DAVIS J H 35152
DAVIS J W *35137
DAVIS K R 34906
DAVIS L C 34992
DAWSON D W *34958
DE LUCA F 34916
DE RYCKE D A C *35011
DE ZAIACOMO A 35151
DEEVY E S JR *35211
DEGRAFF B A *35307
DEHAAS G G *35105
DEHAAS N 35282
DELARUE R 34977
DEMERJIAN K L 35267
DEMETER J J 34953, 35381
DEMSKI R J 34953
DENIAU R *35239
DENNY A F 35311
DESIRE P 35042

DEURINGER R *35175
DEVITOFRANCESCO G 34916
DIFFENDERFER J W *34928
DILLS R L 35024
DIYEV N P *35315
DOERR R C 34943
DOMARADSKI M 35361
DOMINGUEZ E C 35102
DONALDSON C D *35212
DONOVAN L 34994
DORSCENER F 35344
DOST F N *35345, *35373
DREW R T 35330
DRION J *34977
DRISCOLL T *35012
DROZDZ M 35342
DRUM D D *35013
DRUMMOND A J *35240, 35248
DUCSIK D W *34994
DUECKER H C 34989
DUNCAN D C 34940
DUNCAN J R *35375
DUNGWORTH D L *35358
DUNN R L *34918

E

EDWARDS J B *34899
EGGLETON A E J 35236
EGUCHI T *35186
EHHALT D H *35213
EHRENFELD J 34903
EISNER N A 35380
EKDAHL C A *35233
ELBANOWSKI M 35283
ELBERSON J L *35014
ELLIS C W 35094
EMERSON T R 35359
EMERY J F 35164
ENDO Y 35193
ENDRES J L 35331
ENGEL A 35129
ENGEL A J 35399
EPPERLY W R *34996
ERCOLANI C 35313
ERDOS E *35314

F

FABIAN P 35209, *35214
FACY L 35236
FAGLEY W S *34997
FALKNER C 35288
FALLS O B JR *34933
FAN L T 35242
FANKHAUSER R 35194
FARMERY K *34978
FEAZEL C E *34959
FEDER H M 35132
FELDMAN P L *34900
FELLER I *35399
FELSING W A 35323
FERBER G J *35215
FERGUSON J B *35327
FEUERSTEIN D L *34938
FINCH A 35345
FINNEGAN W G *35295
FINNERAN J A *34919
FISHER R 35335
FLEMING R D *34960
FLETCHER W *35093
FLOWER W L 35298
FONTANELLA J C 35124
FONTIJN A *35161
FOOTE C S *35296
FORMIGNANI M 35151
FORTAK H *35241
FORWARD F A *35095
FRANSON K D 35101
FREEMAN A M III *35425
FRIEDMAN R S 35399
FROGER C 35160
FUERST R 35153
FUJII S *34920

G

GABRIEL K L *35346
GADOMSKI R R *34901
GALLILY I *35271
GANDRUD B W 34898
GANEY J M *34998
GANKOVSKIJ B D 35176
GARDNER M J *35332
GARLAND J A *35206
GARRATT J R *35234
GARRISON T W III *34999
GARVIN D *35272
GARY H C *34921
GAUVIN W H 35099
GEARHART G L 35416
GEARY D L 35349
GENTEL J E *34902
GEORGE R 35362
GERLACH J K *34937
GERSHINOWITZ H *35431
GERVASIO V 35294
GILBERT N *34945
GILLS T E 35392
GIMBRONE A V 34901
GOKSOYR H *35189
GOL DENTEYN M A *35138
GOLDEN C *35139
GOLDEN D M 35299
GOLDFEDER L B *34979
GOLDISH J *34903
GOLIKOV V I *35176
GOLOMB D 35161
GOORIAH B D 34917
GORDON R J *35192
GORHAM M J 35383
GOTO M 35166
GRANGE A 35285
GRANTHAM L R F *35015, *35016, *35017
GRAVES J H *35018
GREEN W J 34901, 35089, 35090
GREENE V W 35059
GRIGORYAN G O 35053
GRIGORYAN R V *35053
GUBANOV M T 35056
GUENTHER R *35140
GUGELER D F 35416
GUIDRY J E 34940
GUILBAULT G G *35168
GUINN J A JR 35275
GUIOCHON G 35128
GUYER M 35153

H

HABASHI F *35054
HALL R B *35019
HALL R E *34961
HALVORSEN K 35366
HAMERLAK S *35386
HAMMER D I *35333
HANGEBRAUCK R P *34962
HANSEN G A 35105
HANSON K A 34958
HANSON R K *35298
HANST P L 34943
HARDY L *34980
HARE C T *35141
HARKER A B 35121
HARLOW E V 35116
HARRIS T B *35200
HARTLER N *34934
HARTMANN H F *35391
HASSELBLAD V 35333
HASSERODT U *34922
HAUGEN G R 35299
HAUPT C G *35055
HAYDEL D *35423
HEEREN H *34963
HEINDRYCKX R *35142
HENEIN N A *34904
HENRY J M 34953
HENRY M C *35334
HEREDY L A *35020, *35021
HERGET W F 35131
HERZIGER G 35129
HERZOG S 35339
HICKEY J R 35240
HIDY G M 35152
HILGE H *35022
HILL F B *35216
HINTON L V 35429
HIRANO K *35193
HIRSCHLER D A 35043
HISHINUMA Y 35073
HODGESON J A 35161
HOLDER R C 34958
HOLLINGS H *35115
HOLMAN J L 35107
HOMMA K *35376
HORIE Y *35242
HOUGEN O A 35318
HOUSER E A *35143
HOY R D *35243
HUEBNER R *35177
HULTEBERG A *35082
HUNTER T W 34940
HUNTER W K *35023
HURKO B *35024, *35025
HURN R W *35144

I

IDSO S B *35169
ILIC V *35347
ILLINICZ J *35026
INABA F 35146
INGRUBER O V 35187
INNES W B *35027
IRIE T *35217
ISAHAYA F *34981
ISHIKAWA H 35222
ISHIZAKA Y *35218
ISKANDAROV SH A 35284
IVANCHENKO L V 35130
IVANOV A I *35256

J

JACKSON A *35106
JACKSON W E *34995
JAMES F C *35273
JANSON W A *35028
JARZEBSKI S *34949
JEFFORD C W *35274
JELLINEK H H G *35377
JENSEN P *35426
JEPSON A F *35170
JOHANSSON H O 34982
JOHNSON A R *34982

AUTHOR INDEX

JOHNSON E *35110
JOHNSON J L 35330
JOHNSON S A 35123
JOHNSON W K *35418
JOHNSTON H S *35309
JOHNSTONE H F *35113
JOSEWICH F *35093
JONES A E *35089
JONES R A 35416
JONES W J *35077
JOUAULT P *35178
JYUMONJI M 35146

K

KAFAROV V V *35286
KAHANPAA A *35346
KAKABADZE I L 35109
KAKABADZE V M *35109
KALMYKOV A V *35056
KANADA M 35222
KANAGAWA A *35185
KAPLAN M L *35287
KASAOKA S *35263
KATTAWAR G W 35266, *35275
KAUFMAN D G 35334
KAUFMAN F *35317
KAWADA S 34984
KAWANAMI S *35050
KAY A 34978
KE P J *35171
KEARINS D L *34983
KEARIN D H *35419
KEELING C D 35230, 35233
KELLEHER P G 35287
KELSO J R 35317
KENNEDY L A *34985
KERR A 35273
KERR J A 35267
KERR W B *35162
KIANG C S 35289
KIKUCHI T T *35125
KINKEAD E R *35349
KIRK A G H *35400
KISTIAKOWSKY G B 35307
KITAMURA T 35263
KITAZUME M 35193
KIYOURA R *35084
KLEINMAN M T 35191
KLOUBA J F *35031
KNOP W *35057
KNUTH E L *35145
KNUTH R 35191
KOBAYASHI T *35146
KOIKE K *35219
KOJIMA H *35147
KOJIMA I 35219
KOLB K E *35032
KONIECZNY G 35047
KONOSU H *35163
KORTE F 35166
KORTSCHAK H P *35367
KORZENIOWSKI K 35302
KOSMIDER S 35342
KOSSOWSKI K *35033
KRUGMAN C *35096
KRUGER C H 35291
KUBO S *34984
KULLER L H *35335
KULOOR N R 35302
KUPS S *34925
KURTZROCK R C *35078

L

LAAG A E 34995
LAFFER M H 35274
LAFLEUR P D 35382
LAIDLER J J 35329
LAKEY L T 35142
LAMB F W 35043
LAMOUREUX R L 35419
LANCASTER B *35276
LANGAN L 35170
LANGER G *35344
LARSEN C M 35016
LARSON R E *35084
LAULAINEN N *35432
LAVE L B *35411
LAWTHER P J *35359
LEBLANC F *35368
LEBOWITZ M D *35297
LECH J F *35148
LEE G *35099
LEE R E JR 35150, *35194
LEGATSKI L K *34985
LEIBACH E *35035
LENZ H P *35058
LEONARDOS G *35174
LESOURD D A 35384
LEVITT A *35436
LIEBERMAN A *35288
LINDSTROM E G *35036
LINDSTROM R E 34912
LINSKY B 34997
LIPINA T G *35277
LIST R J 35215
LIU B Y H *35179
LIVSHITS G S 35256
LLEWELLYAN P M *35180
LODGE J P JR *35181
LODGE M P 35181
LONG R 35304
LONNEMAN W *35149
LOOMIS R C *35369
LOPEZ ROMAN A 35168
LOWRY W P *35259
LU K C 35257
LUCIAK M *35342
LUEBS R E *34906
LUGOVOI V V 35069
LUKENS T.C *35412
LUND R E 35111
LUNDGREN D A *35059
LUX H *35203
LYKINS J D 35320
LYON W S *35164
LYBEROW N A *35182

M

MACHTA L *35235
MACLEOD K E *35150
MAIZZA V *34929
MALTONI G G *35151
MAMMARELLA L *35220
MANARY O J 34902
MARGOLIS G 34985
MARKOWITZ S S 35126
MARKVART M *35308
MARONI V A 35132
MARPLE V A 35179
MARTIN J C 35160
MARTINEZ J D 35371
MARZOCCHI A 35294
MASHIKO Y 35163
MASSEY O D *35097
MATTHEWS W H *35415
MATULA R A *34987
MAZAIKA P K *34998
MCATEE R E 35142
MCBEAN K D *34941
MCCARGAR D 34982
MCCREA D H 35078
MCCUBBIN T L *35097
MCGREGOR J L 35245
MCGUIRE G E 35205
MCKELVEY V E *34940
MCKENZIE D E 35021
MCKINNEY J D *35098
MCLAREN J *35080
MCLAY C L *35370
MCREE D I *35427
MEEKER J 35153
MEGONNELL W H *35420
MENNEN A 34968
MELANDRI C 35151
MENZEL D C 35390
MENZIES R T *35165
MERRISON D F *35061
MERY P 35239
MESZAROS E *35221
METRAILER W J 35088
MEYER R A *35152
MEYERS S *35401
MICK A *34935
MIESSE C C *35080
MILLARD R I 35331
MILLER M R *35062
MILLER S G *34986
MILLIGAN S 34994
MINAMINO O 34920
MINNICK L J *35092
MIYAMOTO S 34965, 34966
MOHNEN V A 35289
MORDELET DAMBRINE M *35336
MORIARTY R M 35274
MORIK J *35195
MORITA Y *35222, *35278
MORRITZ F L 35101
MORTON B R *35245
MOYERS J L 35127, 35286
MUDD J B *35353
MULIK J *35153
MUNN R E *35236
MUNRO W P 35320
MURK J B *35439
MUROMTSEVA L S 35065
MURPHY E M 35098
MURRAY R W *35309
MYERS P S *34989

N

NABBS E 35354
NAGASAKA J 35222
NAGLE E V 35085
NAJARIAN H K *35111
NAKABAYASHI K 35063
NAKAMURA K *35154
NAKAMURA M 35193
NAKAMURA R *35328
NAKASHIO F *35312
NARDELLI E 35294
NATHANY M 35371
NEARY M P 35264
NEELS G J 35398
NESHKOV N S *35350
NEUWIRTH R *35204
NEWHALL H K 34909, *34910
NICKELL L G *34930, 35367
NICKERSON B G *35435

NICOLET M *35209
NIITSU Y *35063
NILSEN K O 34921
NISHIDA K *35155
NISHIMOTO S 34984
NISHIMURA T 35186
NISHIYAMA K 35402
NIWA K *35402
NORSETH T *35354
NORTON C M *35001
NORTON HALL T 34978
NOVAKOV T 35121

O

O CONNOR J R *35205
O GRADY F W 35359
O NEAL H E 35299
OFFUTT W C 35038
OGLE E M 35288
OGLESBY S JR 34959
OKAMURA K 35193
OLEFFE J 35356
OLIN H L *35320
OLIN J G 35429
ONO A 35119
OREN M R *35156
OTSUKA Y 35376
OWERS M J *35207
OZAO S 35217

P

PACK D H 35236
PADDOCK R E *35384
PADUCHEV V V 35315
PALTRIDGE G W *35246
PAPET LEPINE J *35253
PARCZEWSKI W *35247
PARKER O G 35011
PARKHURST R B 35326
PARPART J *35064
PARROT J L 35336
PARSA B *35126
PAVLOV V Y 35256
PAWLEK F E 34937
PEARMAN G I 35234
PEMBROOK J D 35134
PENGIDORE D A *34964
PERPER J 35335
PETERS M S *35107, 35303
PETERSON H G 35033
PETERSON J L 34923
PETERSON K F 35111
PINAEV V A *35065
PITTS J N JR 35303
PLANTS K D 34953, 35381
PLASS G N 35265, 35275
PLATA R L 35358
POLLOCK W H 34898
POPOVIC K 35347
POROWSKI L 35026
PORTNOY B 35333
POUR V 35308
POWELL A W 35207
POWERS J O *35428
POZZANI U C 35349
PRADEL J 34977
PRATHER R J *34965, *34966
PRODI V 35151
PUNCH G 35387
PURDOM P W *34926

Q

QUARLES J *35388, *35403, *35404
QUARM T A A *34987
QUIG R H 34990

R

RADFORD E 35335
RAHLENBECK U *35438
RAJAGOPALAN K V 35330
RANGER A E 34948
RANWEILER L E *35127
RAO D N 35368
RAO M N 35050
RAYMOND A *35128
READINGS C J 35206
REDDY Y B *35290
REED D J 35345, 35373
REGIER L W 35171
REINERS W A *35223
RENAULT P *35039
RICHARDS H 35012
RICHARDSON J A *35157
RICHARDSON R W *34911
RICHARDSON W C 35301
RICKER C W *35260
RICKLES R N *35002
RIDDERVOLD J *35366
RIESE C H *35101
RIMBAULT C G 35274
ROBBINS R C *35183
ROBERTS E J *34942
ROBINSON G D *35248
ROBINSON J W *35371
ROBUCK R D 34986
RODGERS A S 35299
ROGER D 35285
ROLLINS R 35131
ROMARY F 35336
ROMEO P L *35040, 35087
ROOK H L *35392
ROSEN J D *35291
ROSENDAHL F *35041
ROSS K 35189
ROSS R A 35077
ROY N C 35050
ROZIE M *35042
RUHLING A *35372
RUSHTON J D *34988
RUSSELL C S *35413
RUSSELL P B 35228
RYAN D J 35094
RYLANDER R *35340

S

SACCO J F 35399
SAKABE H 35376
SAKANISHI T 35402
SANCHEZ M G *34989
SANDERSON J G *35405
SARINGER M K 35195
SARTORI G *35313
SATO K 35219
SATO M 35163
SAVAGE K I 35070
SAWICKI E 35139, 35153
SAWYER R F *35066
SCACCIA C 34905
SCHARF H B *35102
SCHEINER B J *34912
SCHEPERS G W H *35351
SCHMIDT BURBACH G M *35224
SCHMIDT F H 35236
SCHNEIDER N R *35337
SCHNYDERS H C 35132
SCHONBERG M 35198, 35196
SCHREINER W C 34956
SCHWANECKE R *35067
SCHWARZ M 35362
SCHWEBOLD D J 34952
SCORER R S *35261
SCOTT W E 34943
SEIDL W 35438
SEITZ W R *35264
SEKIKAWA T 35147
SEKINE T *35068
SELUCKY M L *35172
SEPPAR A M *35069
SETSER D W *35301
SHAH I S *34990
SHANKS D E 34912
SHAW R 35299
SHEDLOVSKY J P 34888
SHEPHERD J G *35208
SHESTOPALOV V V 35286
SHILOV E 34946
SHIOZAWA K *35422
SHIVELY W L *35116
SHY C M *35355
SIEGMUND C W *34950
SIEMER D D 35148
SIGSBY J E 35120
SILVERSTEIN J *35201
SIMONS J P 35273
SINFELT J H 35045
SKAPERDAS G T 34956
SKIBIN D *35225
SKORIK L D *35279
SMITH T B *35249
SMITH W T *35326
SOLBETT J M 35106
SOO S L *35226
SORVALL V *35433
SPEDDING D J 35375
SPOFFORD W O JR 35413
SPRINGER G S *34913
SPRINGER K J 35141
SREEDHARAN C R 35227
ST AMAND P 35295
STAFFORD R G *34967
STANTON R W 35019
STARKMAN E S 35066
STAUFFER D *35280
STEEL D R 35091
STEELE D R 35087, 35089
STEIN G *35374
STEPHENS E R *34943
STEPHENS R E *35043
STILES A C *35323
STORY P R 35309
STUFFEL M 35336
SUBRAMANYAM M V *35302
SUETSUGU S *35338
SUN S C *35070
SUNAHARA H *35166
SUZUKI I *35071
SUZUKI M 35193
SUZUKI S *35072
SWENSON L K *34923
SWIFT D 35335
SYRYCZYNSKI Z 35322

T

TAKATS T V *35379
TAKAYASU M 35278
TAKEUCHI J 35219

AUTHOR INDEX

TAKEUCHI T *35044
TAMURA Z *35073
TANNY G *35187
TARRANT RF *35257
TARRONI G 35151
TAYLOR W F *35045
TEDER A 34896
TEYFEL Y A 35256
THOMPSON W I III *35173
TIERNEY D *35339
TIWARI S N *35158
TIWARI V S *35227
TOONKEL L 35196
TOONKEL L E *35190
TOPOROVA V V 35315
TORRES ACUNA N 35054
TRAIN R E *35389, *35390, *35395, *35396, *35397, *35406, *35407
TRAVIERE J A 34980
TRAYLOR T G 35269
TSANG W *35281
TSCHUDI T *35129
TSIRUL NIKOV L M 35279
TSUMAKI H 35263
TURNER D W 34930
TWOMEY S *35250
TYLER G 35372
TYLER J M *35429

U

ULBRICH E A *35416
URIK P L *35421
UTHE E E *35228
UYEHARA O A 34909

V

VAKHRUSHEV I A *35292
VALENTA J C 34902
VALI G *35251
VAN BERCKEL F W *35103
VAN LUVEN A L *35085
VARKONYI T 35195
VASSY A 35253
VEDOVA R 35035
VELECKIS E 35132
VELTMAN H 35095
VENTURA J C *35361
VIDEBAEK J *35363
VIGY M *35437
VOGEL R C 35132
VOLCHOK H L 35190, *35191, *35196
VOLK W 34982

W

WALSH R 35299
WALSH W H *35003
WANG C H 35345, 35373
WANG T J Y 35377
WARNQVIST B 34896
WARREN D R *35074
WARTBURG A F 34898
WASSER J H 34961
WATTS R N 35104
WAYNE R P *35303
WEATHERLY M L P M 34917
WEAVER E A *35252
WECKER M *35310
WEGST W F JR 35260
WEHNER A P *35343
WEHRLE P F 35333
WEICKMANN J 35244
WEILL H *35362
WELLS A E *35118
WELLS G D *34991
WESLER J E *35430
WESTENBERG A A *35282
WESTLEY F *35293
WHEELOCK T D *35075
WHITMORE P J *34968
WILHELMSSON G *35046
WILHOYTE H J 35062
WILKE D F *34992
WILLIAMS J A 35119
WILLIAMS P C 34944
WILSON M J G *35258
WOJTCZAK J *35283
WOLFSON D E *34993
WOMER W H 34914
WONG H N 35318
WOODRIFF R 35148
WYMAN J 35341

Y

YAMAMOTO S *35229
YANG J 35339
YANG R T 35123
YATES W E 35010
YAZDANI H 35179
YEARY R A 35337
YOKOCHI A 35185
YOKOYAMA O 35229
YONEYAMA E 35193
YOSHIDA K *35408
YOSHIKAWA A 35063
YOSHIMOTO S 35186
YOSHINAGA Y 35193
YOSHIZAWA S 35217
YOSIM S J 35021
YOST D M 35319
YOUSSEFYEH R D 35309
YUSHOK W *35112

Z

ZACHARKIW P B *34914
ZALOGIN N G *34969
ZAWADZKI J *35322
ZENTGRAF K M *35076, *35079
ZETTWOC P 34977
ZISKIND M 35362
ZURAKOWSKI S *35047

ORDER FORM

USE RESTRICTED AS INDICATED IN THE INTRODUCTION

SEND TO:

ENVIRONMENTAL PROTECTION AGENCY
AIR POLLUTION TECHNICAL INFORMATION CENTER
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

Date ____________________

Name ____________________

Program ____________________

Address ____________________

THIS FORM IS TO BE USED FOR ORDERING MICROFICHE DUPLICATES. INDICATE THE ARTICLES YOU REQUIRE BY CIRCLING THEIR APTIC NUMBERS. IF YOU DO NOT HAVE ACCESS TO A MICROFICHE READER, YOU MAY REQUEST PAPER COPIES. HOWEVER, MICROFICHE CAN USUALLY BE PROVIDED IN ABOUT 1/5 THE TIME REQUIRED TO PROVIDE PAPER COPIES.

55233 55247 55250 55432 55433 55434 55435 55504 55505 55506 [illegible] 55509 55510
55511 55512 55535 55540 55548 55550 55557 55569 55635 55647 55713 55715 55716 55717
55718 55735 55784 55802 55829 55931 55937 55938 55940 55950 56067 56077 57032 57050
57056 57067 57075 57093 57777 57778 57779 57780 57781 57782 57783 57784 57785 57786
57787 57788 57789 57790 57791 57792 57793 57794 57795 57796 57797 57798 57799 57800
57801 57802 57803 57804 57805 57806 57808 57809 57811 57812 57816 57817 57818 57819
57820 57821 57822 57823 57824 57825 57826 57827 57828 57829 57830 57831 57832 57833
57834 57835 57836 57837 57838 57840 57841 57842 57843 57844 57845 57847 57848 57851
57852 57853 57854 57855 57857 57858 57859 57860 57861 57862 57863 57864 57865 57866
57867 57868 57869 57870 57871 57872 57873 57874 57875 57876 57877 57878 57879 57880
57881 57882 57883 57884 57885 57886 57887 57888 57889 57890 57891 57892 57893 57894
57895 57896 57897 57898 57899 57900 57901 57902 57903 57904 57905 57906 57907 57908
57909 57910 57911 57912 57913 57914 57915 57916 57917 57918 57919 57920 57921 57922
57923 57924 57925 57926 57927 57928 57929 57930 57931 57932 57933 57934 57935 57936
57937 57938 57939 57940 57941 57943 57944 57945 57947 57948 57949 57950 57952 57953
57954 57955 57956 57957 57958 57959 57960 57962 57963 57964 57965 57966 57967 57969
57970 57971 57976 57977 57978 57979 57981 57982 57983 57984 57985 57986 57987 57988
57989 57990 57991 57992 57993 57994 57995 57996 57997 57998 57999 58000 58001 58002
58003 58004 58005 58006 58007 58008 58009 58010 58011 58012 58013 58014 58015 58016
58017 58018 58019 58020 58021 58022 58023 58024 58025 58026 58027 58028 58029 58030
58031 58032 58033 58034 58035 58036 58037 58038 58039 58040 58041 58042 58043 58044
58045 58046 58047 58048 58049 58050 58051 58052 58053 58054 58055 58056 58057 58058
58059 58060 58061 58062 58063 58064 58065 58066 58067 58068 58069 58070 58071 58072
58073 58074 58075 58076 58077 58078 58079 58080 58081 58082 58083 58084 58085 58086

58088 58089 58090 58091 58092 58093 58094 58095 58096 58097 58098 58099 58100 58101
58102 58103 58104 58105 58106 58107 58108 58109 58110 58111 58112 58113 58114 58115
58116 58117 58118 58119 58120 58121 58122 58123 58124 58125 58126 58127 58128 58129
58130 58131 58132 58133 58134 58135 58136 58137 58138 58139 58140 58141 58142 58143
58144 58145 58146 58147 58148 58149 58150 58151 58152 58153 58154 58155 58156 58157
58158 58160 58161 58162 58163 58164 58165 58166 58167 58168 58169 58170 58171 58172
58173 58174 58175 58176 58178 58179 58180 58181 58182 58183 58184 58185 58186 58187
58188 58189 58190 58191 58192 58193 58194 58195 58196 58197 58198 58199 58200 58201
58202 58203 58204 58205 58206 58208 58209 58210 58211 58212 58213 58214 58215 58216
58217 58218 58219 58220 58221 58222 58223 58224 58225 58226 58227 58228 58229 58230
58231 58232 58233 58234 58235 58236 58237 58238 58239 58240 58241 58242 58243 58244
58245 58246 58247 58248 58249 58250 58251 58252 58253 58254 58255 58256 58258 58259
58260 58261 58262 58263 58264 58265 58266 58267 58268 58269 58270 58271 58272 58273
58274 58275 58276 58277 58278 58279 58280 58281 58282 58283 58284 58285 58286 58287
58288 58289 58290 58291 58293 58294 58295 58296 58297 58298 58299 58300 58301

*U.S. GOVERNMENT PRINTING OFFICE:1974 546-318/368 1-3